

2005

# Clemson Graduate School Catalog, 2005-2006

Clemson University

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CLEMSON  
UNIVERSITY



# CLEMSON

UNIVERSITY



## GRADUATE ANNOUNCEMENTS

### 2005-2006



## VISION STATEMENT

Clemson University will be one of the nation's top 20 public universities.

## MISSION STATEMENT

The mission of Clemson University is to fulfill the covenant between its founder and the people of South Carolina to establish a "high seminary of learning" through its historical land-grant responsibilities of teaching, research, and extended public service.

Clemson University is a selective, public, land-grant university in a college-town setting along a dynamic southeastern corridor. The University is committed to world-class teaching, research, and public service in the context of general education, student development, and continuing education. Clemson's desire is to attract a capable, dedicated, and diverse student body of approximately 12,000 to 14,000 undergraduate and 4,000 to 5,000 graduate students, with priority to students from South Carolina.

Clemson offers a wide array of high quality baccalaureate programs built around a distinctive core curriculum. Graduate and continuing education offerings respond to the professions, while doctoral and research programs contribute to the economic future of the state, nation, and world. The University emphasizes agriculture, architecture, business, education, engineering, natural resources, science, and technology. The University also promotes excellence in education and scholarship in selected areas of the creative arts, health, human development, the humanities, and social sciences. In all areas, the goal is to develop students' communication and critical-thinking skills, ethical judgment, global awareness, and scientific and technological knowledge. Students remain the primary focus of the University.

Just as Clemson values its students, the University also values its faculty and staff who have committed their talents and careers to advance its mission. Clemson pledges to support their work, to encourage their professional development, to evaluate their professional performance, and to compensate them at nationally competitive levels.

## PURPOSE OF CATALOG

The purpose of this catalog is to give a general description of Clemson University and to provide prospective students with detailed information regarding the various colleges and departments within the University and curricula offered by the University. Inasmuch as the educational process necessitates change, the information and educational requirements in this catalog represent a flexible program which may be altered where such alterations are thought to be in the mutual interest of the University and its students.

The provisions of this catalog do not constitute a contract which may be accepted by students through registration and enrollment in the University. The University reserves the right to change without notice any fee, provision, offering, or requirement in this catalog and to determine whether a student has satisfactorily met its requirements for admission or graduation. The University further reserves the right to require a student to withdraw from the University for cause at any time.

Each plan of study shall be governed by the requirements in effect on the date of enrollment. If a student withdraws from the University and subsequently returns or does not remain continuously enrolled (summers excluded), the requirements in effect at the time of return will normally prevail.

## STUDENT RESPONSIBILITY

All colleges and departments establish certain academic requirements that must be met before a degree is granted. Advisors, department chairs, and deans are available to help the student understand and meet these requirements; but the student is responsible for fulfilling them. If, at the end of a student's course of study, the requirements for graduation have not been satisfied, the degree will not be granted. For this reason, it is important for students to acquaint themselves with all academic requirements throughout their graduate careers and to be responsible for completing all requirements within prescribed deadlines and time limits.

Students registering at Clemson University accept and agree to abide by all published policies and regulations, including those which appear in this document, those published in any official University publication such as the *Student Handbook* and the *Undergraduate Announcements*, and those published on any official University Web site. Unless specifically noted otherwise, all policies and regulations apply equally to graduate students and undergraduate students.

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# ACADEMIC CALENDAR

## Fall Semester 2005

August 21–22, Su–M	Orientation
August 22–23, M–Tu	Late registration
August 23, Tu	University Convocation
August 23, Tu	Freshmen Convocation
August 24, W	Classes begin; late enrollment fee applies
August 30, Tu	Last day to register or add a class
September 6, Tu	Last day to drop a class or withdraw from the University without a W grade
September 13, Tu	Last day to order diploma for December graduation
October 12, W	Last day for instructors to issue mid-term grades
October 14, F	Last day to drop a class or withdraw from the University without final grades
October 17–18, M–Tu	Fall break
November 7, M	Registration for spring, Maymester, and summer terms begins
November 23–25, W–F	Thanksgiving holidays
December 8–9, Th–F	Classes meet; exams permitted in labs only
December 10–17, Sa–Sa	Examinations
December 19, M	9:00 A.M.—Deadline to submit candidate grades
December 21, W	9:00 A.M.—Deadline to submit other grades
December 21, W	Candidates for graduation may access grades
December 22, Th	Graduation

## Spring Semester 2006

January 8–9, Su–M	Orientation
January 9–10, M–Tu	Late registration
January 11, W	Classes begin; late enrollment fee applies
January 16, M	Martin Luther King, Jr. holiday
January 18, W	Last day to register or add a class
January 25, W	Last day to drop a class or withdraw from the University without a W grade
February 1, W	Last day to order diploma for May commencement
March 1, W	Last day for instructors to issue mid-term grades
March 3, F	Last day to drop a class or withdraw from the University without final grades
March 20–24, M–F	Spring break
April 3, M	Registration for fall semester begins
April 8–15, Sa–Sa	Honors and Awards Week
April 27–28, Th–F	Classes meet; exams permitted in labs only
April 29–May 6, Sa–Sa	Examinations
May 9, Tu	9:00 A.M.—Deadline to submit candidate grades
May 10, W	9:00 A.M.—Deadline to submit other grades
May 11, Th	Candidates for graduation may access grades
May 12, F	Commencement
	9:30 A.M. (Colleges AF&LS, AA&H, E&S)
	2:30 P.M. (Colleges B&BS, HE&HD)

## Maymester 2006

May 15, M	Late registration and first day of class
May 16, Tu	Last day to register; late enrollment fee applies
May 17, W	Last day to drop a class or withdraw from the University without a W grade
May 20, Sa	Classes meet
May 22, M	Last day for instructors to issue mid-term grades
May 23, Tu	Last day to drop a class or withdraw from the University without final grades
May 27, Sa	Classes meet
May 30, Tu	Examinations
June 2, F	9:00 A.M.—Deadline to submit all grades

## First Summer Session 2006

May 22, M	Late registration
May 23, Tu	Classes begin; late enrollment fee applies
May 24, W	Last day to register or add a class
May 26, F	Last day to drop a class or withdraw from the University without a W grade
June 7, W	Last day for instructors to issue mid-term grades
June 8, Th	Last day to drop a class or withdraw from the University without final grades
June 12, M	Last day to order diploma for August graduation
June 27, Tu	Examinations
June 29, Th	9:00 A.M.—Deadline to submit all grades

## Second Summer Session 2006

July 4, Tu	Holiday
July 5, W	Orientation
July 6, Th	Late registration
July 7, F	Classes begin; late enrollment fee applies
July 8, Sa	Classes meet
July 10, M	Last day to register or add a class
July 11, Tu	Last day to drop a class or withdraw from the University without a W grade
July 15, Sa	Classes meet
July 20, Th	Last day for instructors to issue mid-term grades
July 21, F	Last day to drop a class or withdraw from the University without final grades
August 9, W	Examinations
August 10, Th	2:00 P.M.—Deadline to submit candidate grades
August 11, F	9:00 A.M.—Deadline to submit other grades
August 11, F	Candidates for graduation may access grades
August 12, Sa	Graduation



**Fall Semester 2006**

August 20–21, Su–M	Orientation
August 21–22, M–Tu	Late registration
August 22, Tu	University Convocation
August 22, Tu	Freshmen Convocation
August 23, W	Classes begin; late enrollment fee applies
August 29, Tu	Last day to register or add a class
September 5, Tu	Last day to drop a class or withdraw from the University without a W grade
September 12, Tu	Last day to order diploma for December graduation
October 11, W	Last day for instructors to issue mid-term grades
October 13, F	Last day to drop a class or withdraw from the University without final grades
November 6–7, M–Tu	Fall break
November 8, W	Registration for spring, Maymester, and summer terms begins
November 22–24, W–F	Thanksgiving holidays
December 7–8, Th–F	Classes meet; exams permitted in labs only
December 9–16, Sa–Sa	Examinations
December 18, M	9:00 A.M.—Deadline to submit candidate grades
December 20, W	9:00 A.M.—Deadline to submit other grades
December 20, W	Candidates for graduation may access grades
December 21, Th	Graduation

**Spring Semester 2007**

January 7–8, Su–M	Orientation
January 8–9, M–Tu	Late registration
January 10, W	Classes begin; late enrollment fee applies
January 15, M	Martin Luther King, Jr. holiday
January 17, W	Last day to register or add a class
January 24, W	Last day to drop a class or withdraw from the University without a W grade
January 31, W	Last day to order diploma for May commencement
February 28, W	Last day for instructors to issue mid-term grades
March 2, F	Last day to drop a class or withdraw from the University without final grades
March 19–23, M–F	Spring break
April 2, M	Registration for fall semester begins
April 7–14, Sa–Sa	Honors and Awards Week
April 26–27, Th–F	Classes meet; exams permitted in labs only
April 28–May 5, Sa–Sa	Examinations
May 8, Tu	9:00 A.M.—Deadline to submit candidate grades
May 9, W	9:00 A.M.—Deadline to submit other grades
May 10, Th	Candidates for graduation may access grades
May 11, F	Commencement
	9:30 A.M. (Colleges AF&LS, AA&H, E&S)
	2:30 P.M. (Colleges B&BS, HE&HD)

**Maymester 2007**

May 14, M	Late registration and first day of class
May 15, Tu	Last day to register; late enrollment fee applies
May 16, W	Last day to drop a class or withdraw from the University without a W grade
May 19, Sa	Classes meet
May 21, M	Last day for instructors to issue mid-term grades
May 22, Tu	Last day to drop a class or withdraw from the University without final grades
May 26, Sa	Classes meet
May 29, Tu	Examinations
June 1, F	9:00 A.M.—Deadline to submit all grades

**First Summer Session 2007**

May 21, M	Late registration
May 22, Tu	Classes begin; late enrollment fee applies
May 23, W	Last day to register or add a class
May 25, F	Last day to drop a class or withdraw from the University without a W grade
June 6, W	Last day for instructors to issue mid-term grades
June 7, Th	Last day to drop a class or withdraw from the University without final grades
June 11, M	Last day to order diploma for August graduation
June 26, Tu	Examinations
June 28, Th	9:00 A.M.—Deadline to submit all grades

**Second Summer Session 2007**

July 2, M	Orientation
July 3, Tu	Late registration
July 4, W	Holiday
July 5, Th	Classes begin; late enrollment fee applies
July 6, F	Last day to register or add a class
July 7, Sa	Classes meet
July 9, M	Last day to drop a class or withdraw from the University without a W grade
July 19, Th	Last day for instructors to issue mid-term grades
July 20, F	Last day to drop a class or withdraw from the University without final grades
August 8, W	Examinations
August 9, Th	2:00 P.M.—Deadline to submit candidate grades
August 10, F	9:00 A.M.—Deadline to submit other grades
August 10, F	Candidates for graduation may access grades
August 11, Sa	Graduation

Note: Dates on this calendar were accurate at the time of printing. Dates, however, may change as conditions warrant. Current information is available on the Web at [www.registrar.clemson.edu/html/acad\\_cal.htm](http://www.registrar.clemson.edu/html/acad_cal.htm).



# ADMINISTRATION

## UNIVERSITY GOVERNANCE AND ADMINISTRATION

The University is governed by a board of 13 members, six selected by the State Legislature and seven self-perpetuating life members, in accord with the will of Thomas Green Clemson. The Board of Trustees is primarily responsible for adopting the long-range objectives of the University and the basic policies for achieving them, providing policy instruction for long-range planning, adopting the statutes of the University, electing the president of the University, employing the secretary of the board, maintaining ownership of University assets, and overseeing the evaluation of the University.

The president is the chief executive officer of the University, providing leadership to all phases of University planning, coordinating the operations of all units of the University, carrying out major University public relations functions, evaluating the results of University plans, and appointing personnel who report to the president. The day-to-day operations of the University are administered by the president and executive officers for advancement, public service and agriculture, and student affairs.

The Provost and Vice President for Academic Affairs is the chief academic officer of the University. The Provost is responsible directly to the president for all academic matters and has administrative jurisdiction over teaching and computing services. Vice provosts assist in administering and performing duties in coordinating graduate and undergraduate curricula; supervising computer information services, the libraries, scholarship and award programs; and other duties assigned by the Provost.

Academic deans are the chief administrative officers of their individual colleges and report directly to the Provost. They provide leadership in formulating and carrying out educational policy, review and make recommendations on personnel matters, and carry out and administer the academic and financial affairs of their colleges.

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# GENERAL INFORMATION

Additional information can be found on the Web at [www.clemson.edu](http://www.clemson.edu).

## HISTORY

When one man of wisdom and foresight can look among the despair of troubled times and imagine what could be, great things can happen. That is what the University's founder, Thomas Green Clemson, was able to do in the post-Civil War days. He looked upon a South that lay in economic ruin, once remarking that "conditions are wretched in the extreme" and that "people are quitting the land." Still, among the ashes he saw hope. Mr. Clemson envisioned what could be possible if the South's youth were given an opportunity to receive instruction in scientific agriculture and the mechanical arts. He once wrote, "The only hope we have for the advancement of agriculture (in the U.S.) is through the sciences, and yet there is not one single institution on this continent where a proper scientific education can be obtained." When he was president of the Pendleton Farmers Society in 1866, Mr. Clemson served on a committee whose purpose was to promote the idea of founding an institution for "educating the people in the sciences" and "which will in time secure permanent prosperity."

When he died on April 6, 1888, a series of events began that marked the start of a new era in higher education in the state of South Carolina, especially in the study of science, agriculture, and engineering. Mr. Clemson's passing set the stage for the founding of the university that bears his name—the beginning of a true "people's university," which opened the doors of higher education to all South Carolinians, rich and poor alike. In his will, which was signed November 6, 1886, Mr. Clemson bequeathed the Fort Hill plantation and a considerable sum from his personal assets for the establishment of an educational institution of the kind he envisioned. He left a cash endowment of approximately \$80,000 as well as the 814-acre Fort Hill estate to South Carolina for such a college. The biggest obstacle in the creation of an agricultural college—the initial expense—was removed by Mr. Clemson's bequest.

On November 27, 1889, Governor Richardson signed the bill accepting Thomas Clemson's gift. Soon after a measure was introduced to establish the Clemson Agricultural College, with its trustees becoming custodians of Morrill Act and Hatch Act funds made available for agricultural education and research by federal legislative acts. The founding of Clemson Agricultural College supplanted the South Carolina College of Agriculture and Mechanics, which had been designated in Columbia in 1880.

Thomas Green Clemson came to the foothills of South Carolina when he married Anna Maria Calhoun, daughter of South Carolina's famous statesman John C. Calhoun.

Born in Philadelphia, Mr. Clemson was educated at schools both in the United States and France, where he attended lectures at the Royal School of Mines, studied with prominent scientists in the private laboratories of the Sorbonne Royal College of France, and received his diploma as an assayer from the Royal Mint in Paris. Mr. Clemson, then in his mid-20s, returned to America greatly influenced by his European studies. He became a great advocate of the natural sciences, achieving a considerable reputation as a mining engineer and a theorist in agricultural chemistry. He also was a gifted writer whose articles were published in the leading scientific journals of his day, an artist and a diplomat who represented the U.S. government as *chargé d'affaires* to Belgium for almost seven years.

Mr. Clemson had a lifelong interest in farming and agricultural affairs. He served as the nation's first superintendent of agricultural affairs (predecessor to the present secretary of agriculture position) and actively promoted the establishment and endowment of the Maryland Agricultural College in the 1850s. Though remembered today for these accomplishments, Thomas Clemson made his greatest historical contribution when, as a champion of formal scientific education, his life became intertwined with the destiny of educational and economic development in South Carolina. Although he never lived to see it, his dedicated efforts culminated in the founding of Clemson Agricultural College.

At the time of his death, Mr. Clemson was living at the Fort Hill homeplace, which today is a national historic landmark and provides a historic centerpiece for the Clemson University campus. He had inherited the house and plantation lands of his famous father-in-law, Senator Calhoun, upon the death of Mrs. Clemson in 1875.

Clemson College formally opened in July 1893, with an enrollment of 446. From the beginning, the college was an all-male military school. It remained this way until 1955, when the change was made to "civilian" status for students, and Clemson became a coeducational institution. In 1964, the college was renamed Clemson University as the state legislature formally recognized the school's expanded academic offerings and research pursuits.

On November 27, 1989, the University observed the 100<sup>th</sup> anniversary of the State's acceptance of the terms and conditions of Mr. Clemson's bequest.

The enrollment of Clemson has grown from 446 students at the opening of the University to 17,110 for the first semester 2004-2005. Of this number, 3,174 were graduate students. Approximately 2,128 were classified as full-time graduate students and 1,046 as part-time students. Since the opening of the University, 93,656 students have been awarded Bachelor's degrees. During this same period, 426 Associate degrees, 25,660 Master's, 326 Education Specialist, 2,511 Doctor of Philosophy, and 103 Doctor of Education degrees have been awarded, a total of 122,682 degrees.

Today, more than a century later, the University is much more than its founder ever could have imagined. With its diverse learning and research facilities, the University provides an educational opportunity not only for the people of the State, as Mr. Clemson dreamed, but for thousands of young men and women throughout the country and the world.

## THE CAMPUS

The 1,400-acre University campus is sited on the former homestead of statesman John C. Calhoun. Nestled in the foothills of the Blue Ridge Mountains and adjacent to Lake Hartwell, the campus commands an excellent view of the mountains to the north and west, some of which attain an altitude of over 5,000 feet above mean sea level.

The Norfolk and Southern Railway and U.S. Highways 76 and 123 provide easy access to the City of Clemson and to the University. Oconee County Airport is four miles from the library. Both Atlanta and Charlotte are two hours driving time away.

Campus architecture is a pleasing blend of traditional and modern facilities enhanced by a beautiful landscape of towering trees, grassy expanses, and flowering plants. Academic, administrative, and student service buildings on campus represent an insured value of \$627 million. Clemson University's real estate holdings include over 32,000 acres of forestry and agricultural lands throughout the state, the majority of which are dedicated to Clemson's research and public-service missions.

Fort Hill, the former home of John C. Calhoun inherited by Thomas Clemson, and the Hanover House are listed on the National Register of Historic Places and are open to the public. The campus also has two recognized Historic Districts.

The Strom Thurmond Institute houses the institute offices, Senator Thurmond's papers and memorabilia, and the special collections of the Cooper Library. The Institute is a part of an instructional and public-service district that includes the Brooks Center for the Performing Arts and the Madren Center for Continuing Education.

## ACCREDITATION

Clemson University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award the Bachelor's, Master's, Education Specialist, and Doctor's degrees. Curricula are accredited by AACSB International (Association to Advance Collegiate Schools of Business), Accreditation Board for Engineering and Technology, American Council for Construction Education, American Dietetic Association, American Society of Landscape Architects, Computing Science Accreditation Board, Council for Accreditation of Counseling and Related Education Programs (CACREP), National Architectural Accrediting Board, National Association of Schools of Art and Design, National Council for Accreditation of Teacher Education, National League for Nursing Accrediting Commission, NRPA/AALR Council on Accreditation, Planning Accreditation Board, and Society of American Foresters. Documentation of accreditation is available in the college deans' offices.



## INTERNATIONAL SERVICES

International Programs and Services (IPS) provides support services to all foreign students and exchange visitors in academic, financial, social, and personal matters relating to their nonimmigrant status (F-1 and J-1) in the United States. IPS also serves as the official liaison between the University and the U.S. Department of Homeland Security's Bureau of Citizenship and Immigration Services (USCIS) and the U.S. Department of State's Bureau of Educational and Cultural Affairs (ECA). Upon arrival at Clemson University, foreign students and exchange visitors are required by U.S. regulation to report immediately to the IPS Office in E-208 Martin Hall to register their arrival at Clemson with USCIS.

### Students

Among the primary services provided to international students are (1) preparing and issuing documents (Immigration form I-20 and State Department form DS-2019) for securing visas before students come to the United States; (2) advising students on U.S. immigration regulations and procedures; (3) assisting with completion of paperwork to maintain legal status while enrolled at Clemson; (4) providing assistance with USCIS registration; (5) determining employment and practical training eligibility; (6) generally interpreting University policy and procedures; and (7) facilitating a smooth adjustment to Clemson University and the community through initial orientations and ongoing workshops.

IPS advisors issue visa documents and provide advice to foreign students and exchange visitors on matters pertaining to immigration issues. The Gantt Intercultural Center works closely with members of the community organization, Clemson Area International Friendship (CAIF), to help students and exchange visitors become familiar with American customs and traditions. Students and exchange visitors needing support in how to negotiate the local environment or who simply want to make friends with American families may seek assistance from staff in the Gantt Intercultural Center.

### Exchange Visitors

Internationals who attend Clemson as short-term, non-degree-seeking students or visiting researchers are known as "exchange visitors." The Responsible Officer (RO) for the Exchange Visitor Program issues the State Department Form DS-2019 and serves as the official contact at the University for all matters pertaining to the Exchange Visitor Program. IPS assists the exchange visitor with issues that may involve the sponsoring department or exchange visitor's government.

### Services to the Community

IPS provides services to the broader community by developing and participating in cultural learning opportunities and programs that engage U.S. and international students, faculty, and staff. The first week of April has been designated as International Awareness Week at Clemson University. During this week, IPS and the Office of Multicultural Affairs work together to create a concentrated focus on world issues and to generate a variety of cultural, political, and educational programs across the campus. The International Festival, now in its 14<sup>th</sup> year, is a culminating event which draws on average 5,000 visitors.

## LIBRARIES

The Libraries' Web site ([www.lib.clemson.edu](http://www.lib.clemson.edu)) provides access to a multitude of information resources, including the library catalog, hundreds of databases, over 14,000 electronic journals, and information regarding library services.

Among the services the Libraries provide are circulation, reference, interlibrary loan, class instruction, and tours. Cooper Library houses a computer lab, maintained by DCIT, Java City Cyber Café, Snax & Stax convenience store, and a Popular Reading and Audiobooks Collection. Equipment available includes photocopiers, scanners, fax machines, and wireless laptops in Cooper Library and a color laser printer, engineering plotter, and large-format photocopier in the Gunnin Architecture Library.

The Clemson University Libraries consist of a main library and three branches. R. M. Cooper Library, Clemson's main library, is a six-level building located at the center of campus. Most of the books and journals are located there, as well as government publications, microforms, and electronic materials. The Gunnin Architecture Library, located in Lee Hall, contains collections that focus on architecture, city and regional planning, construction science, landscape architecture, and visual arts. Special Collections, on the lower level of the Strom Thurmond Institute, houses the rare book collection, University Archives, and many manuscript collections, including the papers of John C. Calhoun and Thomas Green Clemson. The Chemistry Reading Room, located in Hunter Chemistry Lab, contains periodical literature related to chemistry.

Total holdings for the library system include more than 1.6 million items in the form of books, periodicals, electronic resources, government publications and patents, musical recordings, DVDs and videos, audiobooks, maps, and microforms.

## COMPUTING FACILITIES

The Division of Computing and Information Technology (DCIT), on the Web at [dcit.clemson.edu](http://dcit.clemson.edu), supports the computing activities of students and employees with a comprehensive network of computers. DCIT maintains many computer labs throughout the campus, ten of which are public access. The labs contain high-end PCs running Windows XP and laser printing equipment. Students have access to the Internet, e-mail, and Microsoft Office 2003, which includes Word, Excel, and PowerPoint applications.

DCIT's Educational Technology Services (ETS) provides computer training and support to faculty, staff, and students in the use of the MyCLE portal and Web-based course management systems (Blackboard), the Clemson computer network, E-portfolios, and many desktop applications. This training is offered as part of regular University courses, through short courses, through special training programs, and through E-learning courses. Complete information about MyCLE and other ETS services is available at [ets.clemson.edu](http://ets.clemson.edu).

Distance-learning processes and technologies are supported by ETS with the goal of enhancing the design, production, and delivery of an increasing selection of University distance-education courses.

An extensive array of computer hardware is housed at the Information Technology Center (ITC) in the Clemson Research Park. DCIT operates a statewide computing network incorporating processors from a variety of vendors. The major general purpose computers are an IBM z800 running the OS/390 operating system and a SUN E3000 UNIX system. Novell and Solaris servers provide computing resources for client-server computing. Approximately 5,000 computers are connected to the campus FDDI/Ethernet network.

### DCIT Support Center

DCIT provides support and consulting in a comprehensive Support Center located in the University Union. This Support Center serves as a central point of contact for those who need general computing services and laptop support and consultation. DCIT's laptop, help desk, client support, and lab support groups are housed in the Support Center. Other DCIT Help Desks are located in M section Martin Hall and in the Cooper Library on Level 5. These Help Desks assist students in the use of DCIT's hardware, software, and services. Students may call 656-3494, e-mail [consult@clemson.edu](mailto:consult@clemson.edu), or check the information and hours of operation on the Web at [helpdesk.clemson.edu](http://helpdesk.clemson.edu).

### Wireless Access

The campus computer network can be accessed through wired network connections found in all on-campus residence halls and apartments or through the University's extensive wireless network. This wireless access network provides 802.11b coverage to most areas of Clemson's campus. Students wishing to connect to the wireless network are encouraged to buy a wireless card with Cisco certified extensions. More information and complete coverage details, including a list of compatible wireless cards, can be found on the Web at [wireless.clemson.edu](http://wireless.clemson.edu).

### Security

Clemson University requires all users to run virus protection and install the latest OS patches on their computers. Clemson has a site license for the McAfee products, VirusScan (Windows), and Virex (MacOS), which are located on the Software Archive at [download.clemson.edu](http://download.clemson.edu).

## CLEMSON UNIVERSITY FOUNDATION

The Clemson University Foundation is a nonprofit organization that solicits, manages, and administers gifts from private sources for academic programs at Clemson University.

Chartered in 1933, the Foundation is a primary component of the Advancement Program at the University. There are 36 elected members of the Board of Directors. Currently, 34 of the 36 are Clemson alumni. The Board also includes seven automatic directors, including an undergraduate student representative; 15 ex officio directors, including a graduate student representative; and 16 honorary directors.



The Foundation operates through committees that report via an Executive Committee to the full Board. These include the Budget Review, Development, Investment, Nominations, and Policy and Bylaws committees. The Audit Committee is responsible directly to the Board. Fund raising is managed by the Development Committee and, if applicable, a Campaign Executive Committee. This includes solicitation of annual, major, planned, corporate, and foundation gifts in support of University priorities and coordination of college-based fund-raising initiatives. Organizations affiliated with the Clemson University Foundation include the Clemson University Continuing Education/Conference Complex Corporation, the Clemson University Real Estate Foundation, and the Wallace F. Pate Foundation for Environmental Research and Education. As of June 30, 2003, the Clemson University Foundation managed more than 1,000 endowments. Its managed investment portfolio totaled \$231.8 million.

## CLEMSON ALUMNI ASSOCIATION

The Clemson Alumni Association's action phrase is "Your Lifelong Connection to Clemson." Its mission is to serve, to inform, to involve. The Alumni Association works for the more than 100,000 alumni located around the world, sponsoring programs to provide a link between students of yesterday, today, and tomorrow.

In conjunction with volunteers and traveling University staff, Clemson Clubs and Clemson activities are conducted around the world. Alumni are kept informed through the award-winning *Clemson World* magazine and on the Web at [alumni.clemson.edu](http://alumni.clemson.edu). Students, alumni, and constituency programs, as well as publications and electronic resources, form the basis for an array of services offered to alumni, students, parents, and friends of the University.

All services of the National Alumni Association are coordinated out of the Alumni Center, a campus focal point built, furnished, and equipped entirely by gifts from alumni specifically for that purpose. The University Visitors Center, a gift of the Class of 1944, is adjacent to the Alumni Center and is an excellent stop for anyone visiting or returning to campus.

Alumni-sponsored awards programs such as Alumni Distinguished Service, Alumni Fellows, professorships, scholarships, and awards for outstanding teaching, research, and public service are among the prestigious awards given by the University.

Alumni employees coordinate the Alumni Career Services program and the activities of the open-membership student organization, Student Alumni Association. From the Welcome Back Festival held each August to the Senior Picnic held each May, the Alumni Association provides a lifelong connection to Clemson.

## CAMPUS VISITS AND TOURS

The Visitors Center serves as a "front door" to the campus and offers a variety of informational services, including guided tours, audio-visuals, general and referral information, and publications about the University and surrounding area. The Visitors Center is located adjacent to the Alumni Center. Hours of operation are Monday–Friday, 8:00 A.M.–4:30 P.M., Saturday, 9:00 A.M.–4:30 P.M.; and Sunday, 1:00–4:30 P.M. The Visitors Center is closed on University holidays.

Guided walking tours of the campus are led by students who are members of the all-volunteer University Guide Association. Tour times are Monday–Saturday at 9:45 A.M. and 1:45 P.M. and Sunday at 1:45 P.M. Tours begin and end at the Visitors Center. Visitors should try to arrive 10–15 minutes early. Reservations are required. Additional information, including a current schedule, is available on the Web at [www.clemson.edu/welcome/vcenter/center/index.htm](http://www.clemson.edu/welcome/vcenter/center/index.htm) or by phone at 864-656-4789.



# ADMISSION

Admission information is available on the Web at [www.clemson.edu/admission/](http://www.clemson.edu/admission/).

## APPLICATION FORMS AND DATES

On-line applications are available on the Web at [www.grad.clemson.edu](http://www.grad.clemson.edu). Application forms may also be obtained by writing the Office of Admissions, Clemson University, 101 Sikes Hall, Box 345124, Clemson, SC 29634-5124. Applications for admission of United States citizens and residents should be received no later than five weeks prior to the first day of class. Every required item in support of the application (completed application form, application fee, transcripts from each post-secondary school attended, letters of recommendation, and test scores) must be on file with the Office of Admissions by this date. *Note:* Some programs have earlier deadlines or stricter admission requirements. Applicants are encouraged to contact academic departments for additional information.

Applications from prospective international students should be completed by April 15 for fall semester enrollment and September 15 for spring semester enrollment. Every required item in support of the application (completed application form, application fee, transcripts from each post-secondary school attended, letters of recommendation, test scores, and financial certificate) must be on file with the Office of Admissions by these dates. For students who have submitted acceptable financial certification, issuance of form I-20 or form DS-2019 for a student visa will normally be completed by June 1 and October 15 for registration in the fall and spring semesters, respectively. Initial enrollment of international students in the summer sessions is discouraged.

Applicants must submit a nonrefundable application fee of \$50 (subject to change) for each program applied to, payable to Clemson University via money order or check drawn on a U.S. bank. Applicants who apply electronically may pay the application fee by credit card. The application fee must be received before the application is processed. Applications will be discarded after 60 days if the fee is not received.

## ADMISSION CLASSIFICATIONS

Candidates for admission to a degree program will be admitted in one of the following categories:

*Full status*—The applicant's credentials equal or exceed all minimum admission criteria prescribed for the particular degree.

*Provisional status*—At least one admission criterion prescribed for the particular degree is marginal. Provisional applicants will be required to remove the provisional status with a satisfactory academic performance during the first semester.

*Conditional acceptance*—At least one item required for admission is not available. Notice of conditional acceptance may be given to highly qualified appli-

cants prior to receipt of the degree they are presently pursuing; however, all requirements for this degree must be completed prior to enrolling in the proposed graduate program at Clemson. Likewise, conditional acceptance may be given prior to receipt of satisfactory GRE or GMAT scores, if required, but such scores must be received prior to or during the first semester of enrollment.

Seniors lacking less than a full semester of work to complete the requirements for their bachelor's degrees may apply to a graduate program and, if granted conditional acceptance, be allowed to enroll in courses for graduate credit.

In addition to meeting the minimum, general requirements for admission listed below, students must be recommended for admission by the program coordinator or department chair and must meet any special departmental requirements.

## ACADEMIC REQUIREMENTS

### New Applicants

In general, admission to any of the University's graduate programs requires that prospective students hold at least a four-year bachelor's degree from an institution whose scholastic rating is satisfactory to the University. Prospective students must have the approval of the appropriate department chair or program coordinator. Although the quality of an applicant's previous academic record always plays an integral role in any admission decision, a general division of requirements, based on the degree objective, follows:

*Master of Arts, Master of Science, Doctor of Philosophy Degrees*—Applicants must submit satisfactory scores on the general portion of the Graduate Record Examination (GRE).

Applicants to the MS program in Management, PhD program in Management, and MA program in Economics must submit satisfactory scores on either the Graduate Management Admission Test (GMAT) or the Graduate Record Examination (GRE).

*Professional Degrees*—Admission criteria, recommended by the individual colleges awarding the degree, may include professional experience and/or credentials as well as GRE general scores. Specifically, the professional programs in Accounting and Business Administration require satisfactory scores on the GMAT.

*Note:* GRE or GMAT scores more than five years old will not be accepted.

International students, in addition to meeting the minimum requirements above, must submit satisfactory scores on the general portion of the Graduate Record Examination, regardless of the degree objective (except as noted above for the master's programs in Management, Economics, Accounting, and Business Administration, and PhD program in Management). A satisfactory score on the Test of English as a Foreign Language (TOEFL) is also required of international students whose native language is not English. (Note: TOEFL scores more than two years old will not be accepted.) Applicants who hope to receive a graduate assistantship

are encouraged to submit scores from the Test of Written English (TWE). The Graduate School may waive this requirement if the applicant has a demonstrated command of the English language.

Admission to all programs is restricted to those students whose academic records indicate the potential to be successful in graduate studies. This determination is made by the faculty of each graduate program and is affirmed by the Office of Admissions. This determination may include a broad range of performance indicators, which may be different for master's and doctoral programs in the same discipline. These indicators may include, but are not limited to, previous academic (both graduate and undergraduate) performance, standardized test scores, letters of recommendation, personal interviews, applicant statements of interest, portfolio of previous work, and materials indicating the applicant's ability to perform independent research in the discipline. The faculty of each program has significant discretion to determine admission standards and class size based on availability of academic advisors, financial support, laboratory space, student distribution within interest areas, and other resource constraints. The Office of Admissions reserves the right to require additional indicators prior to reaching an admission decision. Neither an academic record exceeding minimum requirements, satisfactory scores on standardized tests, nor professional expertise alone will assure a student's admission in this competitive environment. Rather, the total record must indicate the strong likelihood of successfully completing graduate study.

### Assessment of Previous Academic Work

The grade-point ratio representing an assessment of an applicant's undergraduate work will be based on the last half of the coursework listed on the transcript(s). In conventional cases, this will equate to the full junior and senior years. As a minimum, 60 semester hours (90 quarter hours) will be examined; and in no cases will a partial term, session, or enrollment period be utilized. Courses graded on a pass/fail basis and certain electives having no relationship to a curriculum are excluded in the computation. Departments are at liberty to discount additional courses in assessing an applicant's academic record. Certain professional programs may use the total undergraduate grade-point ratio to satisfy accreditation standards. In evaluating the grade-point ratio of an applicant's graduate work, departments will use all graduate coursework except research and/or courses graded on a pass/fail basis.

### Nondegree Students

Admission in this category is restricted primarily to those who may benefit professionally from additional study at the graduate level. In general, the only supportive material required for such admission is an official transcript showing an appropriate background and confirming the awarding of a bachelor's degree or higher.

Nondegree students may not be candidates for advanced degrees and may not receive a graduate appointment for financial assistance. Should the student subsequently be admitted to a degree program, a maximum of 12 semester hours of graduate credit (nondegree and/or transfer) may be applied toward the degree. In all cases the nondegree student must



receive permission from the program coordinator or the department chair before enrolling in graduate courses. This classification is not open to international students.

Students enrolled in a nondegree status are subject to the same academic regulations regarding continuous enrollment as students in degree programs.

## Teacher Certification or Recertification

Initial certification (endorsement) at the graduate level is available only in Educational Administration, Reading, Personnel Services (Elementary and Secondary Counseling), and Middle Grades (MAT program based at the University Center of Greenville). Students seeking admission to the Educational Administration and Reading programs should hold an appropriate teacher's certificate. MAT admission requires the student to have passed one content area PRAXIS exam.

Students who hold a bachelor's degree or higher and who want initial certification in the teaching areas of early childhood, elementary, secondary, or special education must complete the undergraduate courses needed for certification in a postgraduate status administered by the College of Health, Education, and Human Development Academic Advising Center.

Prospective students should understand that the material in this catalog applies only to requirements for graduate degrees and has no direct relation to certification or recertification for public school teachers. The Graduate School gives no assurance that a program for a graduate degree and a program for a certificate or recertification thereof, will coincide. Students interested in professional certificates should confer with the Academic Advising Center in the College of Health, Education, and Human Development.

## Currently Enrolled Students

Students enrolled in a degree program at Clemson who wish to continue their studies in another graduate program after completing their initial degree may apply by submitting a new application to the Office of Admissions. An application fee is not required if the application is received within one year of completing the initial degree.

## Postbaccalaureate Students

Students may be accepted by the Graduate School as postbaccalaureate if they apply to a graduate degree program but do not have the appropriate academic background. Students must be recommended by the appropriate department or program chair and should meet all other requirements for admission to the degree program with respect to grade-point ratio and standardized test scores. Postbaccalaureate students who are denied admission because of failure to meet the minimum requirements have access to the same appeal procedure as other students applying to the Graduate School.

Applicants will be classified as postbaccalaureate if they are not qualified to take at least one graduate course per semester which can be included in the minimum hours required for the graduate degree. Additionally, students required to complete eight

teen or more semester hours of undergraduate credits prior to enrolling in graduate credits will be classified as postbaccalaureate. The postbaccalaureate status will remain in effect until the number of required undergraduate credit hours is less than or equal to eighteen and the student is qualified to take, each semester, a graduate course which can be included in the minimum hours required for the graduate degree. Departments or students may request postbaccalaureate status even though the above criteria are satisfied.

Once postbaccalaureate students become eligible for classification as graduate students, the decision as to eventual admission status (full or provisional) will be made based on criteria utilized by the department and Graduate School for all other applicants to the degree program. Postbaccalaureate students are expected to maintain a B average and receive no grade lower than C to qualify for admission to a graduate program.

Postbaccalaureate students can enroll in the same number of credits per semester as undergraduate students but cannot enroll in graduate courses or receive graduate assistantships. No degree or certificate shall be awarded to students in a postbaccalaureate status, and such students who subsequently wish to obtain an additional baccalaureate degree must apply through the Office of Admissions. The applicability of credits earned toward the undergraduate degree will be determined by the policy pertaining to transfer students. Tuition and fees for post-baccalaureate students shall be those applicable to undergraduate students and are subject to out-of-state fees, if applicable.

Students possessing undergraduate degrees or graduate degrees who wish to enroll in undergraduate courses for reasons other than future admission to graduate study shall not be classified as postbaccalaureate and shall be governed by policies established by the Office of Admissions.

## University Employees

With the approval of the appropriate dean or director, qualified University employees may pursue graduate work for credit; however, members of the faculty or staff who have rank higher than instructor or its equivalent may not be considered as candidates for advanced degrees in the academic department where employed.

## Readmission

Former graduate students who have not maintained continuous enrollment (summers excluded) but who are eligible to continue in the degree programs in which they were most recently enrolled may be permitted to return.

Students who were enrolled within the last two years must complete an Application for Re-entrance, available from the Enrolled Student Services Office in 104 Sikes Hall or on the Web at [www.grad.clemson.edu](http://www.grad.clemson.edu). Students are readmitted into the degree and major they were in when they last attended Clemson University Graduate School. No application fee is required.

Students who were enrolled more than two years but less than six years previously must complete an Application for Re-entrance, application fee, and

all supporting materials. The application must be approved by the appropriate academic department and must show any intervening graduate work. Appropriate official transcripts of the work may be required by the Graduate School. Revalidation of individual courses is at the discretion of the academic department.

Students who were not enrolled within the past six years are considered new applicants and must submit a new application, application fee, and all supporting materials to the Office of Admissions.

Former Clemson graduate students who wish to return to pursue an undergraduate degree should contact the Registrar's Office for procedures. Former graduate students who wish to pursue undergraduate coursework with no immediate plans for graduate work should contact the Admissions Office for procedures.

## MEDICAL REQUIREMENTS

Graduate students entering Clemson University for the first time must submit a medical history form prior to registration. Students will not be allowed to complete registration without meeting immunization requirements.

The University requires that all new students have documentation of two red measles (rubeola) vaccinations on or after their first birthday. Students born before January 1, 1957, are exempt from the measles requirement. A tuberculin skin test (PPD) is required only of students coming from countries identified by the U.S. Centers for Disease Control as having a high risk for tuberculosis. Students will be screened upon arrival at Clemson. Students with a history of positive skin tests are required to have a chest X-ray within the year prior to admission. Students not in compliance with immunization requirements will not be allowed to complete registration.

## APPEALS

Students may appeal if they believe that admission was unfairly denied. Notice of intention to appeal must be filed in writing with the Office of Admissions within 30 days of the date of the letter indicating rejection and no later than three days prior to the first day of class of the semester of intended first enrollment.

## DEFERRED ADMISSION

Generally, students may defer enrollment for up to one year. Students wishing to defer enrollment must request and receive written approval from the academic department.

## DISPOSITION OF APPLICATION MATERIALS

Credentials or supporting materials submitted for admission to the Graduate School become the property of the University and are not returned. Furthermore, no copies will be provided to a third party outside the University even if the applicant requests this release. Copies will be provided to appropriate offices at the University in the interest of academic matters or financial awards relative to the applicant.



## FINANCIAL INFORMATION

The annual State Appropriation Act imposes the general requirement that student fees be fixed by the University Board of Trustees. The Act imposes two specific requirements on the Board: (1) In fixing fees applicable to academic and general maintenance and operation costs, the Board must maintain a minimum student fee not less than the fee charged the previous year. (2) In fixing fees applicable to dormitory rental, dining halls, laundry, infirmary, and all other personal subsistence expenses, the Board must charge students an amount sufficient to fully cover the cost of providing such facilities and services.

The tuition and fees for all students—full or part time and auditing—are shown at right. Satisfactory settlement of all expenses is a requirement for completing each semester's class registration, and no student is officially enrolled until all past due accounts have been satisfied. Financial aid cannot be used to satisfy balances forward from a prior academic year.

In special cases the University will accept, at the beginning of a semester, a noninterest-bearing promissory note for a portion of the semester housing and semester meal plan fee. Amounts up to \$450 for room rent and \$450 for 5- or 7-day meal plans may be included in the note. In such cases, a note for the fall semester charges will be due October 1, and for the spring semester, March 1. Failure to pay the note when due will result in the assessment of late fees, including collection costs, denial of future deferred payment note privileges, and termination of board plan and/or cancellation of housing contract.

Upon certification by the Dean of the Graduate School and with the authorization of the student of a payroll deduction for payment, deferred payment of academic and health fees may be granted to a student employed as a graduate assistant. The total amount deferred shall not exceed the total of the graduate assistant fees for the semester. Payment of the amount deferred is to be made in six equal installments through payroll deductions beginning with the second pay period of the semester. Should the assistantship be terminated, any unpaid balance of funds deferred is payable immediately as well as any additional fees due. No deferred payments are permitted for summer sessions for any graduate student.

Currently enrolled students who expect to continue enrollment may make housing reservations by paying a \$150 housing advance payment and by pre-registering on-line during the spring semester at a time designated by the Housing Office.

New students who are offered on-campus housing accommodations must pay a nonrefundable \$35 housing application fee and a \$100 admissions deposit. The admissions deposit is deducted from the amount otherwise due for the first semester expenses. (Note: Policies regarding priority to/offering of on-campus housing are subject to change.)

## TUITION AND FEES

Actual charges for 2005-2006 are not known when this catalog is printed. The charges reflected below are for 2004-2005 and are subject to change as conditions warrant.

	Resident Per Semester	Nonresident Per Semester
Full-time graduate academic fee .....	\$3,995.00	\$8,109.00
Part-time graduate academic fee (per credit hour) .....	400.00	676.00
Graduate auditing academic fee (per credit hour) .....	178.00	300.00
Graduate staff academic fee (per credit hour; first four hours free) .....	400.00	
Graduate assistant academic fee .....	918.00	918.00
Laboratory fee (per laboratory) .....	75.00-200.00	75.00-200.00
Health fee (required if enrolled in seven or more hours on campus, regardless of housing arrangements) .....	105.00	105.00
Off-campus rates		
800- and 900-level courses (per credit hour) .....	476.00	816.00
Other graduate courses (per credit hour) .....	400.00	676.00
Undergraduate courses (per credit hour) .....	324.00	676.00
Software license fee (non-refundable) .....	12.00	12.00
Residence Halls (per semester)	Regular	Single
Johnstone (except Annex A) .....	1,100.00	1,650.00
Benet, Bowen, Bradley, Cope, Donaldson, Geer, Johnstone A Annex, Norris, Sanders, Wannamaker, Young .....	1,260.00	1,890.00
Barnett, Byrnes, Lever, Manning, Mauldin, Smith .....	1,390.00	2,085.00
Clemson House (room) .....	1,430.00	2,145.00
Holmes and McCabe .....	1,600.00	2,400.00
Stadium Suites .....	1,830.00	2,745.00
Temporary Housing .....	1,100.00	
Apartments (per semester)		
Calhoun Courts (four occupants) .....	1,685.00	2,530.00
Clemson House .....	1,475.00	2,215.00
Fraternity Area Village .....	2,220.00	
Lightsey Bridge .....	1,765.00	2,650.00
Lightsey Bridge II .....	2,245.00	3,370.00
Thornhill Village (two occupants) .....	1,910.00	2,865.00
Thornhill Village (four occupants) .....	1,505.00	2,260.00
Family Housing		Per Month
Townhouses .....		375.00
Duplex-2 Bedroom .....		390.00
Duplex-3 Bedroom .....		455.00
Faculty Houses .....		500.00
Faculty Houses (Renovated) .....		605.00
Thornhill Graduate Apartments		
9 month .....		385.00
12 month .....		355.00
Board Plans <sup>1</sup>		Per Semester
Any Ten (10 meals), Monday-Sunday .....		925.00
Plus Any Ten (includes \$200 in Paw points) .....		1,100.00
Any 15 (15 meals), Monday-Sunday .....		1,022.00
Plus Any 15 (includes \$100 in Paw points) .....		1,100.00
Seven-day (unlimited access) .....		1,100.00
Plus Unlimited Access (includes \$150 in Paw points) .....		1,250.00
Plus Commuter 50 (any 50 meals per semester plus \$250 in Paw points) .....		552.00
Tiger Stripe Account minimum (declining balance) .....		50.00

<sup>1</sup>All first-year freshmen who live in University housing (excluding apartments with kitchens) are required to subscribe to one of the first five board plans for their first two semesters. All other students have the option of selecting on a semester basis or paying the prevailing cash price for individual meals. The Plus Commuter 50 and Tiger Stripe account do not satisfy the freshman requirement.

## TUITION AND FEES

### Late Enrollment Service Charge

Registration for classes is scheduled for specific days, and definite procedures are outlined to avoid the problems incident to late registration. A student has not completed registration until all required steps have been taken. Any student failing to complete registration on the specified class registration days will incur a late enrollment charge, which begins at \$25 and increases \$5 each day.

### Full-time Enrollment

Students who have graduate assistantships must be enrolled in a minimum of nine semester hours (three hours in a summer session) to be classified full-time students. Students without assistantships must enroll in at least 12 semester hours (three hours in a summer session) to be considered full time. Students who drop below these minimum enrollment requirements may become ineligible for some student services, financial aid, or other programs.



## Part-time Enrollment

Graduate students without assistantships who are enrolled in fewer than 12 credit hours (three hours in a summer session) are classified as part-time and will be charged according to the schedule above. These fees do not provide for admission to athletic events, concert series, and other such activities.

## Mandatory Health Insurance

All graduate students enrolled in nine or more hours on campus are required to have health insurance coverage. All international graduate students must have health insurance as stipulated below.

Enrollment in the University plan, administered by Redfern Health Center, is required unless the student presents verification of alternate coverage. Students covered by their parents', spouse's, or employee health insurance will, in general, find those policies sufficient to meet this condition but must submit a waiver form nonetheless. Insurance plans that restrict enrollment based on national origin, such as those sold to international students only, will not be accepted for waiver. Details are available on the Web at [stuaff.clemson.edu/redfern](http://stuaff.clemson.edu/redfern).

## International Students

International students attending Clemson must purchase the University-sponsored health insurance for themselves and all dependents living in the U.S. Coverage must continue for the duration of the student's stay in the U.S. Students should not purchase health insurance prior to their arrival in Clemson (other than travel insurance). Students will be billed for this insurance coverage with their tuition. Students who bring dependents must purchase dependent health insurance separately at Redfern Health Center. This should be done upon arrival.

Some students who are sponsored by their governments or by certain international programs, such as Fullbright, IIE, Rotary International, or Laspau will have their insurance provided as part of their programs and thus qualify for a waiver of this requirement, as long as these plans are complete and continue to meet Clemson's requirements. Others may have insurance provided as part of an exchange program, such as ISEP. Additional information is available from the Gantt Intercultural Center, 214 Hendrix Center or by phone at 864-656-0437.

With very few exceptions, all international students and exchange visitors/scholars must purchase the insurance plan approved by the University. This expense is included on the I-20 or DS-2019.

## Notice to Customers Making Payment by Check

If a check is mailed for payment, it may be converted into an electronic funds transfer (EFT). This means a copy of the check will be made and the account information will be used to debit the bank account electronically for the amount of the check. The debit from the bank account will usually occur within 24 hours and will be shown on the drawer's bank account statement.

The original check will not be returned to the drawer. It will be destroyed, but University Revenue and Receivables will retain a copy of it. If the EFT cannot be processed for technical reasons, the drawer authorizes the University to process the copy in place of the original check. If the EFT cannot be completed due to insufficient funds, the University may try twice more to make the transfer. A returned item fee of \$25 will be charged and collected by EFT.

## Returned Checks, EFTs, and Credit Card Payments

A check, EFT, or credit card given in payment of University expenses that is returned unpaid by the bank creates an indebtedness to the University. University Revenue and Receivables administers matters relating to the collection of all returned checks.

University Revenue and Receivables will represent returned items for payment of academic fees. A \$25 fee will be charged for each returned item. If a check is returned or dishonored for any reason, the student's account may be debited electronically for the amount of the check plus the \$25 returned item fee.

In addition, students with returned items for payment of academic fees are also subject to a late payment fee of \$5 per calendar day, not to exceed \$350, beginning on the last day of late registration. If the item is returned to the University in a timely manner with no response from the student or drawer, a written request to disenroll the student is made to the Registrar. If the request is approved, the percentage of refund will be applied to the debt. If the item is returned after the mid-point of the semester with no response, a decision will be made by the Director of University Revenue and Receivables and the Registrar as to the effect of disenrollment. The University may restrict subsequent payment for academic and other fees by accepting only cash, certified checks, or money orders.

Any individual who uses a two-party check for payment of University expenses will be held responsible for that check if it is returned unpaid by the bank. Items used as payment for various University services such as meal plans, housing, etc., that are later returned unpaid by the bank, give the University the right to cancel such services and cause forfeiture of any refund.

Any returned items not collected by the above procedures may be turned over to a collection agency and the indebtedness reported to a credit bureau. All collection costs will be added to the debt. Transcripts and diplomas will be withheld pending payment, and the debt may be deducted from state income tax refunds.

Abuse of check payment privileges may result in the restriction of such privileges for an indefinite period of time based on the frequency and/or dollar amount, as determined by University Revenue and Receivables.

## Past Due Accounts

Any indebtedness to the University which becomes past due immediately jeopardizes the student's enrollment, and no such student will be permitted to re-enroll for an ensuing semester or summer term. Billing fees and/or collection costs may be added to the indebtedness. Further, any student who fails to pay all indebtedness, including collection costs, to the University may not be issued a transcript or diploma. Unresolved debts may be turned over to a collection agency, reported to a credit bureau, and deducted from state income tax refunds. Debts include but are not limited to, parking violations, library fines, rent, academic fees, and others.

## Refund of Academic Fees

(Tuition, University Fee, and Medical Fee) for Students Withdrawing, Dropping to Part Time, or Part-time Students Dropping Credit Hours

No refunds will be made on a semester's tuition and fees after four weeks from the last day to register. In the case of withdrawal from the University, refunds will be based on the effective date of the withdrawal. In the case of withdrawal from a course, refunds will be based on the date the student drops the course using the on-line registration system. To be eligible for a refund, the student's request must be received by University Revenue and Receivables prior to the beginning of the next fall/spring semester or subsequent summer term. Beginning with the day following the last day to register, refunds for periods of four weeks or less during fall/spring semester shall be made based on the chart below. Students receiving Title IV Financial Aid follow a different policy. Contact University Revenue and Receivables, G-08 Sikes Hall, for details.

Fall/Spring Semester		Summer Sessions			
Period of Enrollment	Percent Refund	Length of Session Percent Refund			
		Less Than 3 wks.	3 wks.	5 or 6 wks.	More Than 6 wks.
Registration day(s) in published calendar	100%				
After last day to register:					
One week or less	80%				
More than 1 but not more than 2 weeks	60%				
More than 2 but not more than 3 weeks	40%				
More than 3 but not more than 4 weeks	20%				
More than 4 weeks	0%				
Registration day(s) in published calendar		100%	100%	100%	100%
After last day to register:					
One week or less		0%	40%	60%	60%
More than 1 but not more than 2 weeks		0%	0%	20%	40%
More than 2 but not more than 3 weeks		0%	0%	0%	20%
More than 3 weeks		0%	0%	0%	0%



## Refund of Dining Hall Fees

See the section on Dining Services on page 20.

## Refund of Housing Fees

### Cancellation of contract prior to the start of the academic year

New Freshmen, New Graduate Students, New Transfer Students—If written notice of cancellation is received by the Housing Office on or before July 25, 2005, the contract is cancelled with no additional charge. After July 25, 2005, the contract is binding, and students are obligated to pay rent for the entire academic year unless they fail to enroll.

Continuing Undergraduate and Graduate Students, Co-op Students, Former Students Returning—If written notice of cancellation is received by the Housing Office on or before June 1, 2005, the contract is cancelled, and \$100 of the \$150 advance payment is refunded, minus any indebtedness to the University. Students who are not required to pay the \$150 will be charged \$50. Refunds, if applicable, will show as a credit on the following semester's bill. If the student fails to enroll the following semester, a refund check will be issued only after that semester begins. If written notice of cancellation is received by the Housing Office on or between June 2 and July 25, 2005, the contract is cancelled, but no portion of the \$150 advance payment is refunded. Students who are not required to make a \$150 advance payment will be charged \$150 upon cancellation. After July 25, 2005, the contract is binding, and students are obligated to pay the entire academic year's rent unless they fail to enroll. In such cases, all prepaid rent, less \$150, will be refunded.

Students who sign contracts after July 25, 2005, are obligated to pay the entire academic year's rent unless they do not enroll. If a student's plans change and he/she re-enrolls after cancelling, the semester charge will be added back to his/her account. The entire \$150 advance payment is refunded only in cases where the University denies readmission. There will be no refund of University housing monies during the last six weeks of a semester. If any collection fees are assessed in the process of obtaining unpaid housing charges, the student will be responsible for the payment of those collection fees in addition to the unpaid housing charges.

### Cancellation of contract after the start of each semester of the academic year

The contract may be terminated after the start of each semester for the following reasons only: withdrawal from school, marriage (no more than four weeks prior to the wedding date), or circumstances determined by the University to be sufficiently extenuating as to warrant cancellation. Documentary evidence will be required to show cause for cancellation. Any student qualifying for cancellation under one of these conditions will forfeit the first \$150 of that semester's rental fee or the prorated amount for the days of the semester that housing is held in reservation by that student, whichever is greater.

### Cancellation of contract at the end of the first semester

The contract may be terminated at the end of the first semester without penalty for the following reasons: graduation, withdrawal from school, ineligibility to continue enrollment due to a failure to meet academic requirements, completion of graduate requirements, failure to enroll a second semester, participation in Cooperative Education during second semester, or participation during the second semester in any program required by the University that takes the student away from the main campus. The contract may be cancelled at the end of the first semester with a \$150 contract cancellation charge for the following reasons: marriage or circumstances determined by the University to be sufficiently extenuating as to warrant cancellation. The contract may also be cancelled at the end of the first semester by paying 50% of the first semester's rental fee ("buyout" option).

## FINANCIAL ASSISTANCE

### Fellowships and Traineeships

Approximately 140 outstanding graduate students hold fellowships or traineeships at Clemson University. For a monetary award to be designated a fellowship or a traineeship, it must provide the recipient a minimum of \$1,000 for the academic year. These awards, received from a variety of alumni, foundation, governmental, individual, or industrial sources, require no services. Payment in excess of actual educational costs is subject to federal and state taxes.

Graduate Alumni Fellowships, University Research Fellowships, and George R. MacDonald Fellowships are University-wide awards administered by the Graduate School and the Office of Student Financial Aid. These awards of \$5,000 each for the academic year are made on a competitive basis to nominees selected by the academic departments. Scholarly potential and academic excellence are the sole criteria for the awards.

Additional fellowships and traineeships are administered by the individual colleges and academic departments. Some awards, such as the Industrial Graduate Residency Fellowships, may limit students' research to areas of interest to the donor and require a period of residency at the industrial sites. Detailed information is available from the colleges or academic departments.

South Carolina Graduate Incentive Fellowships of \$5,000 for master's students or \$10,000 for doctoral students are available to minority graduate students. These awards are renewable. Master's students must be citizens of South Carolina. Preference is given to new applicants and those who express a commitment to remain and be employed in the state for two years. These fellowships are administered by the Graduate School.

Unless otherwise stipulated by the grantor and/or donor, holders of fellowships or traineeships are required to enroll in the same minimum credit load as other departmental graduate assistants. Continued receipt of any fellowship or traineeship is contingent on the student's maintaining a satisfactory academic status. Normally a student cannot hold concurrently two or more fellowships or traineeships

(or the equivalent) administered by the University, regardless of the funding sources. Fellowship recipients are eligible for appointments as departmental graduate assistants.

Fellowships and traineeships are usually offered in early March. Inquiries may be made to the student's major department or to the Graduate School.

Graduate fellows and trainees pay fees applicable to South Carolina residents. Fellowship and traineeship recipients are eligible for appointment as departmental graduate assistants. For students holding both fellowships or traineeships and assistantships, the fee structure for assistantships prevails.

### Graduate Assistantships

All graduate assistants are granted partial remission of academic and other fees and enjoy certain other benefits provided for University staff. Graduate assistants pay a flat fee per semester or summer session.

All appointments for assistantships (teaching, research, laboratory, administrative, and grader) must be processed on the Graduate Assistantship Tuition Remission. All graduate administrative and graduate extension assistantships (new and continuing) must be approved by the Graduate School before they are offered to the students. Work assignments for students should be as specific as possible and should reflect the relationship to the student's academic program. The work to be performed must be above the paraprofessional level.

To be eligible for any graduate appointment, a graduate student must satisfy the appropriate minimum enrollment requirement described in each section below and the enrollment limit requirements. The University reserves the right to withdraw the appointment at any time because of failure to meet these requirements. Graduate students also should understand that an appointment may be withdrawn at any time for failure to maintain a satisfactory academic status including grades, special examinations, and research efforts.

Clemson University, as a member of the Council of Graduate Schools in the United States, subscribes to the following policy inherent in the resolution adopted by the council regarding graduate appointments. In every case in which an appointment for the next academic year is offered to students currently enrolled in or accepted to graduate programs, the student, if acceptance is indicated before April 15, will have freedom through April 15 to submit, in writing, a resignation of the appointment to accept one elsewhere. An acceptance given or left in force after April 15, however, commits the student not to accept another appointment (at Clemson or elsewhere) without first obtaining a written release from the first party to whom a commitment has been made. Similarly, an offer made after April 15 is conditional on presentation by the student of the written release from any previously accepted offer.

The Southern Association of Colleges and Schools requires that all Graduate Teachers of Record (GTR) have "earned at least 18 graduate semester hours in their teaching discipline, be under the direct supervision of a faculty member experienced in the teaching discipline, receive regular in-service training and be evaluated regularly" (Section 4.8.4 of the SACS Criteria for Accreditation).



The department chair has the responsibility for determining that the 18-hour requirement is met either through coursework or with a memo containing documentation that the graduate assistant meets the requirement as an exception. The Enrolled Student Services Office will certify that the 18-hour requirement has been met.

#### Departmental Graduate Assistantships

Assistantships are available in academic departments involving primarily instruction, research, or extension and in nonacademic departments involving primarily administration. Application forms, available from the Graduate School or from departmental offices, should be filed as early as possible in the academic year before the student enrolls. Selection of assistantship recipients, notification of the appointment, its duration, and the stipend are the responsibilities of the employing departments.

**Eligibility**—To qualify for a departmental assistantship, a student must possess at least a bachelor's degree and be enrolled in a graduate degree program. The student must devote 10–30 hours of service per week to the University and be engaged in employment that bears a recognizable relationship to his/her major field of study. Multiple employment by the University (graduate appointment and/or hourly employment) is permitted. It is the responsibility of the secondary employer to receive permission of the primary employer and the Graduate School prior to assignment of any additional work and to ensure that the maximum work load of 30 hours per week is not exceeded. Upper limits on academic loads as related to hours of service per week are found in the section entitled *Academic Regulations*.

International graduate students who are interested in receiving assistantships should submit Test of English as a Foreign Language (TOEFL) and Test of Written English (TWE) scores. International students seeking graduate teaching assistantships, whose native language is not English and whose secondary education (and beyond) was not taught fully in English, are required to pass the standardized exam Test of Spoken English (TSE). Specialists in English as a Second Language administer this test at Clemson University. Prospective international teaching assistants also undergo an interview during which they are evaluated by faculty members in their respective departments. Some departments utilize videotaped oral presentations. Successful scores on the test, the interview, and the presentation (if required) are completed before the student can be approved as a teaching assistant.

**Minimum Stipend**—The minimum graduate assistantship stipend must be commensurate with a rate 1.2 times the prevailing federal minimum wage.

**Minimum Enrollment**—A minimum enrollment in nine credit hours is required for appointment as a graduate assistant during the academic year. Minimum enrollment in summer sessions is three semester hours per session.

Undergraduate credits may be included in the minimum, provided they are relevant to the student's degree program and are required by the advisory committee. Credits in G S 799 may be included in the minimum in special cases as approved in advance by the Graduate School.

**Employment Schedule and Leave Without Pay**—Graduate students with nine-month or 12-month graduate teaching assistantship appointments work on the same calendar as faculty with nine-month or 12-month appointments, respectively. Duties over holiday periods for graduate research assistantship appointments should be agreed upon in writing by the student and the faculty advisor in charge of the research program.

Graduate assistants may request up to four weeks of leave without pay per semester and one week of leave without pay per summer session for illness of a close family member, death in the immediate family, and personal illness or hardship. If leave is not approved by the administrator of the graduate assistantship, the graduate assistant may petition the Graduate School for approval.

A graduate assistant is eligible for up to six weeks of maternity leave without pay. The request for maternity leave must be made to the department at least one month in advance.

#### Administrative Graduate Assistantships

Administrative units hiring graduate administrative assistants must form a partnership with an academic department or departments. Signatures of the employing supervisor and the academic advisor are required. The academic department shall provide a brief description of the expectations of the employer, the anticipated beginning and ending dates, stipend amount, average hours of service per week, work schedule (where appropriate), and the conditions for reappointment, if any. In addition, the assistant must be apprised of the financial penalties related to academic fees that may be incurred if the assistantship starts after the beginning or is terminated before the end of the semester or session.

#### Graduate Resident Director Assistantships

Part-time employment on the program staff of the residence halls is available to qualified graduate students. Preference is given to those who have had successful undergraduate experience as residence hall assistants. In general, 30 hours of service per week are required. Compensation consists of a room or apartment, partial remission of academic and other fees, and approximately \$4,375 per semester. Graduate resident directors are subject to the enrollment limitations stipulated in the section on *Academic Regulations*, and the required minimum enrollment is coincident with that of departmental graduate assistants. Application should be made directly to the Housing Office.

#### International Student Employment

International graduate students are required to be in proper immigration status before any assistantship can be paid or attending benefits ensue.

Special employment regulations for international students are governed by the Code of Federal Regulations and the Department of Homeland Security/USCIS. Permission for off-campus employment must first be requested through the international student advisors in International Programs and Services. Off-campus employment generally is unavailable to international students during the first academic year and should not be considered as a means of support. Students with F-1 visas may apply to the USCIS for limited off-campus work authorization after their first year of study. Nonacademic employment opportunities are available on campus on a first-come basis. Applications are made directly to the hiring source upon arrival on campus. Further information is available in International Programs and Services (IPS), E-208 Martin Hall; (864) 656-3614.

#### Termination of Assistantships

**Termination of assistantship by student**—Normally an assistantship is offered on an annual or academic year basis. Students may terminate assistantships at the conclusion of a semester or summer session without penalty; however, if students terminate their assistantships during a semester, they may be liable, calculated on a pro rata basis, for the difference between the normal academic fees and the reduced fees assessed as a result of the assistantship. If, in the opinion of the immediate supervisor of the assistantship, the termination was justifiable, the administrator may recommend to the Dean of the Graduate School that no additional charge be made to the student.

**Termination of assistantship for cause**—If, in the opinion of the immediate supervisor of the assistantship, a student is not carrying out the duties of the assistantship satisfactorily, the assistantship may be terminated and the student held liable, calculated on a pro rata basis, for the reduction in academic fees assessed as a result of the assistantship.

The procedure to be followed before terminating an assistantship for cause follows:

The immediate supervisor should first discuss and try to resolve the problem with the student. A record of this conversation is placed in the student's departmental file. If the student's performance remains unsatisfactory, a signed written warning from the department chair is sent to the student by cer-

### Graduate Assistantship Tuition Policy

	Adding Assistantship	Cancelling Assistantship
First 2 weeks of class (fall and spring)	graduate assistantship fee	full tuition and fees
First week of class (summer session)	graduate assistantship fee	full tuition and fees
After last day to add but before last day to drop or withdraw without a <i>W</i> grade	50% of tuition + 100% of fees or graduate assistant fee if new money to the University	100% of tuition and fees, minus graduate assistantship fee paid
After last day to drop or withdraw without final grades	no benefit	no liability



tified or registered U.S. mail detailing the nature of the problem. The Dean of the Graduate School shall be notified. If the performance of the student remains unsatisfactory, the department chair gives the student a written notice of termination. At least two weeks should elapse between the written warning and the notice of termination. The Dean of the Graduate School shall be notified. The student has the right to file a grievance with the Graduate Student Academic Grievance Committee.

*Termination of assistantship because of academic deficiency*—The assistantship may be terminated if the student drops below the minimum credit hours required as described above or for failure to meet other academic requirements.

*Termination of assistantship because of unexpected loss of research funding*—A sudden or unexpected loss of external funding may result in a termination of an assistantship. The policy outlined in the chart below will be used to calculate any tuition and fees required by a graduate student. A department chair may request an exception to the policy with appropriate documentation.

## Loans

The Office of Student Financial Aid administers federal financial aid for graduate students. Many types of federal aid, such as the Federal Pell Grant, are not available to graduate students; however, the Federal Stafford Loan has extended loan limits for graduate students and is available to most students regardless of income. U.S. citizens and eligible non-citizens may apply for the Federal Stafford Loan by completing the Free Application for Federal Student Aid (FAFSA). The suggested deadline to apply is April 1 for the following fall semester.

Graduate students accepted into degree programs may borrow funds to cover their established cost of attendance, less any fellowship stipends or fee waivers, up to \$18,500 per year. Graduate assistants who receive their official assignments after their loans are processed will be required to reduce their loans due to the tuition waiver. Usually this reduction exceeds \$6,000.

Information and application forms are available from the Office of Student Financial Aid, G-01 Sikes Hall, Box 345123, Clemson, SC 29634-5123.

## Eligibility for Loans

To qualify for loans, graduate students must be enrolled in at least five credits in a regular semester (fall or spring) and three credits for the summer in any combination of enrollments.

## Special Employment Restrictions

Graduate students who are employed in programs administered directly or indirectly by Clemson University and are found to be in default on payments of student loans will be subject to wage withholding (garnish) according to Legislative Authority P.L. 102-164; To U.S.C. S1095A et seq.

## Hourly Employment

Employment on an hourly basis for a portion of a semester or session is possible in some departments. The student must be enrolled in at least three credit hours per semester or session in order to accept hourly employment. The maximum credit load is the same as that for graduate assistants (see *Academic Regulations*). Enrolled graduate students (exclusive of full-time University employees) may not be employed by the University for more than 30 hours per week (graduate appointments and hourly employment combined). No portion of the hourly employment shall be used to qualify students for benefits afforded those on graduate assistantship appointments.

## RESIDENT TUITION AND FEES

### Application for Resident Status

Any undergraduate student or prospective student whose status concerning entitlement to payment of in-state tuition and fees is uncertain has the responsibility of securing a ruling from the University by providing all relevant information on special application forms. These forms can be obtained from the Student Financial Aid Office, G-01 Sikes Hall, and are to be completed and returned to that office at least two weeks prior to registration for any semester or summer term for which the student is attempting to qualify for payment of the in-state tuition and fee rate.

### Entitlement

Eligibility for payment of in-state tuition and fees shall be determined under the provisions of Sections 59-112-10 through 59-112-100, South Carolina Code of Laws, 1976, as amended. This law is set forth in its entirety as follows (subject to further amendment by the General Assembly).

### Statutes

**59-112-10—Definitions.** As used in this chapter:

A. The words "State Institution" shall mean those post-secondary educational institutions under the jurisdiction of the following: (1) Board of Trustees, Clemson University; (2) Board of Trustees, Medical University of South Carolina; (3) Board of Trustees, South Carolina State College; (4) State College Board of Trustees; (5) Board of Visitors, The Citadel; (6) Board of Trustees, University of South Carolina; (7) Board of Trustees, Winthrop College; and (8) State Board of Technical and Comprehensive Education.

B. The word "student" shall mean any person enrolled for studies in any state institution.

C. The word "residence" or "reside" shall mean continuous and permanent physical presence within this State, provided, that temporary absences for short periods of time shall not affect the establishment of a residence.

D. The word "domicile" shall mean a person's true, fixed, principal residence and place of habitation; it shall indicate the place where such person intends to remain, and to which such person expects to return upon leaving without establishing a new domicile in another state. For purposes of this section one may have only one legal domicile; one is presumed to abandon automatically an old do-

micile upon establishing a new one. Housing provided on an academic session basis for students at State institutions shall be presumed not to be a place of principal residence, as residency in such housing is by nature temporary.

E. The words "in-state rates" shall mean charges for tuition and fees established by State Institutions for persons who are domiciled in South Carolina in accordance with this act; the words "out-of-state rates" shall mean charges for tuition and fees established by State Institutions for persons who are not domiciled in South Carolina in accordance with this act.

F. The words "independent person" shall mean a person in his majority, or an emancipated minor, whose predominant source of income is his own earnings or income from employment, investments, or payments from trusts, grants, scholarships, loans, or payments of alimony or separate maintenance made pursuant to court order.

G. The words "dependent" or "dependent person" mean: (1) one whose financial support is provided not through his own earnings or entitlements, but whose predominant source of income or support is payments from a parent, spouse, or guardian, and who qualifies as a dependent or an exemption on the federal tax return of the parent, spouse, or guardian; or (2) one for whom payments are made, under court order, for child support and the cost of his college education by an independent person meeting the provisions of Section 59-112-20 A or B. However, the words "dependent" or "dependent person" do not include a spouse or former spouse who is the recipient of alimony or separate maintenance payments made pursuant to court order.

H. The word "minor" shall mean a person who has not attained the age of eighteen years; and the words "emancipated minor" shall mean a minor whose parents have entirely surrendered the right to the care, custody and earnings of such minor and are no longer under any legal obligation to support or maintain such minor.

I. The word "parent" shall mean a person's natural or adoptive father or mother; or if one parent has custody of the child, the parent having custody; or if there is a guardian or other legal custodian of such person, then such guardian or legal custodian; provided, however, that where circumstances indicate that such guardianship or custodianship was created primarily for the purpose of conferring South Carolina domicile for tuition and fee purposes on such child or dependent person, it shall not be given such effect.

J. The word "spouse" shall mean the husband or wife of a married person.

**59-112-20—South Carolina Domicile Defined for Purposes of Rates of Tuition and Fees.** South Carolina Domicile for tuition and fee purposes shall be established as follows in determinations of rates of tuition and fees to be paid by students entering or attending State Institutions:

A. Independent persons who reside in and have been domiciled in South Carolina for a period of no less than twelve months with an intention of making a permanent home herein, and their dependents, may be considered eligible for in-state rates.

B. Independent persons who reside in and have been domiciled in South Carolina for fewer than twelve months but who have full-time employment in the State, and their dependents, may be consid-



ered eligible for in-state rates for as long as such independent person is employed on a full-time basis in the State.

C. Where an independent person meeting the provisions of Section 59-112-20 B above, is living apart from his spouse, or where such person and his spouse are separated or divorced, the spouse and dependents of such independent person shall have domiciliary status for tuition and fee purposes only under the following circumstances: (1) if the spouse requesting domiciliary status for tuition and fee purposes remains domiciled in South Carolina although living apart or separated from his or her employed spouse, (2) if the dependent requesting domiciliary status for tuition and fee purposes is under the legal custody or guardianship, as defined in Section 59-112-101 above, of an independent person who is domiciled in this State; or if such dependent is claimed as an income tax exemption by the parent not having legal custody but paying child-support, so long as either parent remains domiciled in South Carolina.

D. The residence and domicile of a dependent minor shall be presumed to be that of the parent of such dependent minor.

**59-112-30—Effect of Change of Residency.** When the domicile of a student or of the person upon whom a student is financially dependent changes after enrollment at a State Institution, tuition charges shall be adjusted as follows:

A. Except as provided in Section 59-112-20B above, when domicile is taken in South Carolina, a student shall not become eligible for in-state rates until the beginning of the next academic session after expiration of twelve months from date of domicile in this State.

B. When South Carolina domicile is lost, eligibility for in-state rates shall end on the last day of the academic session in which the loss occurs; however, application of this subsection shall be at the discretion of the institution involved.

C. Notwithstanding the other provisions of this section, any dependent person who has been domiciled with his family in South Carolina for a period of not less than three years immediately prior to his enrollment may enroll in a state-supported institution of higher learning at the in-state rate and may continue to be enrolled at such rate even if the parent, spouse, or guardian upon whom he is dependent moves his domicile from this State.

**59-112-40—Effect of Marriage.** Except as provided in Section 59-112-20 above, marriage shall affect determinations of domicile for tuition and fee purposes only insofar as it operates to evince an intention by the parties to make a permanent home in South Carolina.

**59-112-50—Military Personnel and Their Dependents.** Notwithstanding other provisions of this act, during the period of their assignment to duty in South Carolina members of the armed services of the United States stationed in South Carolina and their dependents may be considered eligible for in-state rates. When such armed service personnel are ordered away from the State, their dependents may continue for an additional twelve months to have this eligibility at the State Institutions where they are enrolled at the time such assignment ends. Such persons and their dependents may be considered eligible for in-state rates for a period of twelve months after their discharge from the armed services even though they were not enrolled at a State Institution

at the time of their discharge, if they have evinced an intent to establish domicile in South Carolina and if they have resided in South Carolina for a period of at least twelve months immediately preceding their discharge.

**59-112-60—Faculty, Administrative Employees and Dependents Thereof.** Full-time faculty and administrative employees of State Institutions, and the spouses and children of such persons, shall be excluded from the provision of this act.

**59-112-70—Abatement of Rates for Nonresidents on Scholarship.** Notwithstanding other provisions of this act, the governing boards listed in Section 59-112-10A above, are authorized to adopt policies for the abatement of any part or all of the out-of-state rates for students who are recipients of scholarship aid.

**59-112-80—Administration of Chapter; Burden of Proving Eligibility of Students.** Each State Institution shall designate an official to administer the provisions of this act. Students making application to pay tuition and fees at in-state rates shall have the burden of proving to the satisfaction of the aforesaid officials of State Institutions that they have fulfilled the requirements of this act before they shall be permitted to pay tuition and fees at such rate.

**59-112-90—Penalties for Willful Misrepresentation.** Where it appears to the satisfaction of officials charged with administration of these provisions that a person has gained domiciliary status improperly by making or presenting willful misrepresentations of fact, such persons should be charged tuition and fees past due and unpaid at the out-of-state rate, plus interest at a rate of eight percent per annum, plus a penalty amounting to twenty-five percent of the out-of-state rate for one semester; and until these charges have been paid no such student shall be allowed to receive transcripts or graduate from any State Institution.

**59-112-100—Regulations.** The Commission on Higher Education may prescribe uniform regulations for application of the provisions of this act and may provide for annual review of such regulations.

## ARTICLE V

### Determination of Rates of Tuition and Fees

(Statutory Authority: 1976 Code Sections 59-112-10 to 59-112-100)

#### 62-600—Rates of Tuition and Fees.

A. Resident classification is an essential part of fee determination, admission regulations, scholarship eligibility, and other relevant policies of the state. It is important that such institutions have fair and equitable regulations which can be administered consistently and are sensitive to the interests of both students and the State. The Commission on Higher Education hereby establishes regulations for the Statute Governing Residency and Tuition for Fee Purposes to be applied consistently by all South Carolina institutions of higher education. These regulations do not address residency matters relating to in-county categories used within the State's technical colleges.

B. Institutions of higher education are required by the Statute to determine the residence classification of applicants. The initial determination of

one's resident status is made at the time of admission. The determination made at that time, and any determination made thereafter prevails for each subsequent semester until information becomes available that would impact the existing residency status and the determination is successfully challenged. The burden of proof rests with the student to show evidence as deemed necessary to establish and maintain their residency status.

#### 62-601—Code of Laws Governing Residence. [SC ADC 62-601]

Rules regarding the establishment of legal residence for tuition and fee purposes for institutions of higher education are governed by Title 59, Chapter 112 of the 1976 South Carolina Code of Laws, as amended.

#### 62-602—Definitions. [SC ADC 62-602]

A. "Academic Session" is defined as a term or semester of enrollment. (62-607.B)

B. "Continue to be Enrolled" is defined as continuous enrollment without an interruption that would require the student to pursue a formal process of readmission to that institution. Formal petitions or applications for change of degree level shall be considered readmissions. (62-607.A)

C. "Dependent Person" is defined as one whose predominant source of income or support is from payments from a parent, spouse, or guardian and who qualifies as a dependent or exemption on the federal income tax return of the parent, spouse, or guardian. A dependent person is also one for whom payments are made, under court order, for child support and the cost of the dependent person's college education. A dependent person's residency is based upon the residency of the person upon whom they are dependent. (62-602.G) (62-602.N) (62-603.B) (62-605.C) (62-607.A)

D. "Domicile" is defined as the true, fixed, principal residence and place of habitation. It shall indicate the place where a person intends to remain, or to where one expects to return upon leaving without establishing a new domicile in another state. For purposes of this section, one may have only one legal domicile. One is presumed to abandon automatically an old domicile upon establishing a new one. Housing provided on an academic session basis for student at institutions shall be presumed not to be a place of principal residence, as residency in such housing is by its nature temporary. (62-602.E) (62-602.K) (62-602.M) (62-602.N) (62-603.A) (62-603.B) (62-605.B) (62-605.C) (62-607.A) (62-607.B) (62-608.A) (62-608.C) (62-608.D) (62-609.A.3) (62-609.A.4)

E. "Family's Domicile in this State is Terminated" is defined as an employer-directed transfer of the person upon whom the student is dependent and is not considered to mean a voluntary change in domicile. Also included is a relocation of the person upon whom the student is dependent who is laid off through no fault of his own (e.g., plant closure, downsizing, etc.) who accepts employment in another state prior to relocating. (62-607.A)

F. "Full-time employment" is defined as employment that consists of at least thirty-seven and one-half hours a week on a single job in a full-time status. However, a person who works less than thirty-seven and one-half hours a week but receives or is entitled to receive full-time employee benefits shall be considered to be employed full-time if such sta-



tus is verified by the employer. A person who meets the eligibility requirements of the Americans with Disabilities Act must satisfy their prescribed employment specifications in order to qualify as having full-time employment. (62-605.C.1) (62-609.A.2) (62-609.A.3)

G. "Guardian" is defined as one legally responsible for the care and management of the person or property of a minor child or one qualified to claim a dependent person based upon the five tests for dependency prescribed by the Internal Revenue Service; provided, however, that where circumstances indicate that such guardianship or custodianship was created primarily for the purpose of conferring South Carolina domicile for tuition and fee purposes on such child or dependent person, it shall not be given such effect. (62-602.C) (62-602.E) (62-602.I) (62-602.M) (62-603.B) (62-605.C)

H. "Immediately Prior" is defined as the period of time between the offer of admission and the first day of class of the term for which the offer was made, not to exceed one calendar year. (62-607.A)

I. "Independent Person" is defined as one in his/her majority (eighteen years of age or older) or an emancipated minor, whose predominant source of income is his/her own earnings or income from employment, investments, or payments from trusts, grants, scholarships, commercial loans, or payments made in accordance with court order. An independent person must provide more than half of his or her support during the twelve months immediately prior to the date that classes begin for the semester for which resident status is requested. An independent person cannot be claimed as a dependent or exemption on the federal tax return of his or her parent, spouse, or guardian for the year in which resident status is requested. (62-602.N) (62-603.A) (62-605.C) (62-607.B) (62-608.B)

J. "Minor" is defined as a person who has not attained the age of eighteen years. An "emancipated minor" shall mean a minor whose parents have entirely surrendered the right to the care, custody and earnings of such minor and are no longer under any legal obligation to support or maintain such minor. (62-602.G)

K. "Non-resident Alien" is defined as a person who is not a citizen or permanent resident of the United States. By virtue of their non-resident status "non-resident aliens" generally do not have the capacity to establish domicile in South Carolina. (62-602.M) (62-604.A)

L. "Parent" is defined as the father, mother, stepfather, stepmother, foster parent or parent of a legally adopted child. (62-602.C) (62-602.E) (62-602.I) (62-602.J) (62-602.M) (62-603.B) (62-603.C) (62-605.C)

M. "Reside" is defined as continuous and permanent physical presence within the State, provided that absences for short periods of time shall not affect the establishment of residence. Excluded are absences associated with requirements to complete a degree, absences for military training service, and like absences, provided South Carolina domicile is maintained. (62-603.A) (62-606.B) (62-609.A) (62-609.A.3) (62-609.A.4) (62-609.B)

N. "Resident" for tuition and fee purposes is defined as an independent person who has abandoned all prior domiciles and has been domiciled in South Carolina continuously for at least twelve months

immediately preceding the first day of class of the term for which resident classification is sought and for whom there is an absence of domiciliary evidence in other states or countries, notwithstanding other provisions of the Statute. (62-600.A) (62-600.B) (62-602.I) (62-602.K) (62-602.M) (62-603.A) (62-603.B) (62-603.C) (62-604.A) (62-605.A) (62-605.C) (62-605.C.7) (62-606.A) (62-606.A.5) (62-606.B) (62-607.A) (62-608.B) (62-609.A.3) (62-610.A) (62-610.B) (62-611.A) (62-611.B)

O. "Spouse" is defined as the husband or wife of a married person in accordance with Title 20, Chapter 1 of the 1976 South Carolina Code of Laws, as amended. (62-602.C) (62-602.E) (62-602.I) (62-602.M) (62-603.B) (62-605.C)

P. "Temporary Absence" is defined as a break in enrollment during a fall or spring semester (or its equivalent) during which a student is not registered for class. (62-606.A)

Q. "Terminal Leave" is defined as a transition period following active employment and immediately preceding retirement (with a pension or annuity), during which the individual may use accumulated leave. (62-609.A.4)

R. "United States Armed Forces" is defined as the United States Air Force, Army, Marine Corps, Navy, and Coast Guard. (62-606.B) (62-609.A(1))

#### **62-603—Citizens and Permanent Residents. [SC ADC 62-603]**

A. Independent persons who have physically resided and been domiciled in South Carolina for twelve continuous months immediately preceding the date the classes begin for the semester for which resident status is claimed may qualify to pay in-state tuition and fees. The twelve-month residency period starts when the independent person establishes the intent to become a South Carolina resident per section 62-605 entitled "Establishing the Requisite Intent to Become a South Carolina Domiciliary." Absences from the State during the twelve-month period may affect the establishment of permanent residence for tuition and fee purposes.

B. The resident status of a dependent person is based on the resident status of the person who provides more than half of the dependent person's support and claims or qualifies to claim the dependent person as a dependent for federal income tax purposes. Thus, the residence and domicile of a dependent person shall be presumed to be that of their parent, spouse, or guardian.

C. In the case of divorced or separated parents, the resident status of the dependent person may be based on the resident status of the parent who claims the dependent person as a dependent for tax purposes; or based on the resident status of the parent who has legal custody or legal joint custody of the dependent person; or based on the resident status of the person who makes payments under a court order for child support and at least the cost of his/her college tuition and fees.

#### **62-604—Non-Resident Aliens, Non-Citizens, and Non-Permanent Residents. [SC ADC 62-604]**

A. Except as otherwise specified in this section or as provided in section 62-609 (1) and (2), independent non-citizens and non-permanent residents of the United States will be assessed tuition and fees at the non-resident, out-of-state rate. Independent non-resident aliens, including refugees, asylees,

and parolees may be entitled to resident, in-state classification once they have been awarded permanent resident status by the U.S. Department of Justice and meet all the statutory residency requirements provided that all other domiciliary requirements are met. Time spent living in South Carolina immediately prior to the awarding of permanent resident status does not count toward the twelve month residency period. Certain non-resident aliens present in the United States in specified visa classification are eligible to receive in-state residency status for tuition and fee purposes as prescribed by the Commission on Higher Education. They are not, however, eligible to receive state sponsored tuition assistance/scholarships.

B. Title 8 of the Code of Federal Regulations (CFR) serves as the primary resource for defining visa categories.

#### **62-605—Establishing the Requisite Intent to Become a South Carolina Domiciliary. [SC ADC 62-605]**

A. Resident status may not be acquired by an applicant or student while residing in South Carolina for the sole purpose of enrollment in an institution or for access to state-supported programs designed to serve South Carolina residents.

B. If a person asserts that his/her domicile has been established in this State, the individual has the burden of proof. Such persons should provide to the designated residency official of the institution to which they are applying any and all evidence the person believes satisfies the burden of proof. The residency official will consider any and all evidence provided concerning such claim of domicile, but will not necessarily regard any single item of evidence as conclusive evidence that domicile has been established.

C. For independent persons or the parent, spouse, or guardian of dependent persons, examples of intent to become a South Carolina resident may include, although any single indicator may not be conclusive, the following indicia:

- (1) Statement of full-time employment;
- (2) Possession of a valid South Carolina voter registration card;
- (3) Designating South Carolina as state of legal residence on military record;
- (4) Possession of a valid South Carolina driver's license or, if a non-driver, a South Carolina identification card. Failure to obtain this within 90 days of the establishment of the intent to become a South Carolina resident will delay the beginning date of residency eligibility.
- (5) Possession of a valid South Carolina vehicle registration card. Failure to obtain this within 45 days of the establishment of the intent to become a South Carolina resident will delay the beginning date of residency eligibility.
- (6) Maintenance of domicile in South Carolina;
- (7) Paying South Carolina income taxes as a resident during the past tax year, including income earned outside of South Carolina from the date South Carolina domicile was claimed;
- (8) Ownership of principal residence in South Carolina; and
- (9) Licensing for professional practice (if applicable) in South Carolina.

D. The absence of indicia in other states or countries is required before the student is eligible to pay in-state rates.



**62-606—Maintaining Residence.** [SC ADC 62-606]

A. A person's temporary absence from the State does not necessarily constitute loss of South Carolina residence unless the person has acted inconsistently with the claim of continued South Carolina residence during the person's absence from the State. The burden is on the person to show retention of South Carolina residence during the person's absence from the State. Steps a person should take to retain South Carolina resident status for tuition and fee purposes include:

- (1) Continuing to use a South Carolina permanent address on all records;
- (2) Retaining South Carolina voter's status;
- (3) Maintaining South Carolina driver's license;
- (4) Maintaining South Carolina vehicle registration;
- (5) Satisfying South Carolina resident income tax obligation. Individuals claiming permanent residence in South Carolina are liable for payment of income taxes on their total income from the date that they established South Carolina residence. This includes income earned in another state or country.

B. Active duty members of the United States Armed Forces and their dependents are eligible to pay in-state tuition and fees as long as they continuously claim South Carolina as their state of legal residence during their military service. Documentation will be required in all cases to support this claim. South Carolina residents who change their state of legal residence while in the military lose their South Carolina resident status for tuition and fee purposes.

**62-607—Effect of Change of Residency.** [SC ADC 62-607]

A. Notwithstanding other provisions of this section, any dependent person of a legal resident of this state who has been domiciled with his/her family in South Carolina for a period of not less than three years and whose family's domicile in this state is terminated immediately prior to his/her enrollment may enroll at the in-state rate. A student must continue to be enrolled and registered for classes (excluding summers) in order to maintain eligibility to pay in-state rates in subsequent semesters. Transfers within or between South Carolina colleges and universities of a student seeking a certificate, diploma, associate, baccalaureate, or graduate level degree does not constitute a break in enrollment.

B. If a dependent or independent person has been domiciled in South Carolina for less than three years, eligibility for in-state rates shall end on the last day of the academic session during which domicile is lost. Application of this provision shall be at the discretion of the institution involved. However, a student must continue to be enrolled and registered for classes (excluding summers) in order to maintain eligibility to pay in-state rates in subsequent semesters.

**62-608—Effect of Marriage.** [SC ADC 62-608]

A. In ascertaining domicile of a married person, irrespective of gender, such a review shall be determined just as for an unmarried person by reference to all relevant evidence of domiciliary intent.

B. If a non-resident marries a South Carolina resident, the non-resident does not automatically acquire South Carolina resident status. The non-resident may acquire South Carolina resident sta-

tus if the South Carolina resident is an independent person and the non-resident is a dependent of the South Carolina resident.

C. Marriage to a person domiciled outside South Carolina shall not be solely the reason for precluding a person from establishing or maintaining domicile in South Carolina and subsequently becoming eligible or continuing to be eligible for residency.

D. No person shall be deemed solely by reason of marriage to a person domiciled in South Carolina to have established or maintained domicile in South Carolina and consequently to be eligible for or to retain eligibility for South Carolina residency.

**62-609—Exceptions.** [SC ADC 62-609]

A. Persons in the following categories qualify to pay in-state tuition and fees without having to establish a permanent home in the state for twelve months. Persons who qualify under any of these categories must meet the conditions of the specific category on or before the first day of class of the term for which payment of in-state tuition and fees is requested.

- (1) "Military Personnel and their Dependents": Members of the United States Armed Forces who are permanently assigned in South Carolina on active duty and their dependents are eligible to pay in-state tuition and fees. When such personnel are transferred from the State, their dependents may continue to pay in-state tuition and fees for an additional twelve months. Such persons (and their dependents) may also be eligible to pay in-state tuition and fees for a period of twelve months after their discharge from the military, provided they have demonstrated an intent to establish a permanent home in South Carolina and they have resided in South Carolina for a period of at least twelve months immediately preceding their discharge. Military personnel who are not stationed in South Carolina and/or former military personnel who intend to establish South Carolina residency must fulfill the twelve month "physical presence" requirement for them or their dependents to qualify to pay in-state tuition and fees.
- (2) "Faculty and Administrative Employees with Full-Time Employment and their Dependents": Full-time faculty and administrative employees of South Carolina state-supported colleges and universities and their dependents are eligible to pay in-state tuition and fees.
- (3) "Residents with Full-Time Employment and their Dependents": Persons who reside, are domiciled, and are full-time employed in the State and who continue to work full-time until they meet the twelve-month requirement and their dependents are eligible to pay in-state tuition and fees, provided that they have taken steps to establish a permanent home in the State. Steps an independent person must take to establish residency in South Carolina are listed in section 62-605 entitled ("Establishing the Requisite Intent to Become a South Carolina Domiciliary").
- (4) "Retired Persons and their Dependents": Retired persons who are receiving a pension or annuity who reside in South Carolina and have been domiciled in South Carolina as prescribed in the Statute for less than a year may be eligible for in-state rates if they maintain residence and domicile in this State. Persons on terminal leave who have established residency in South Carolina may be eli-

gible for in-state rates even if domiciled in the State for less than one year if they present documentary evidence from their employer showing they are on terminal leave. The evidence should show beginning and ending dates for the terminal leave period and that the person will receive a pension or annuity when he/she retires.

B. South Carolina residents who wish to participate in the Contract for Services Program sponsored by the Southern Regional Education Board must have continuously resided in the State for other than educational purposes for at least two years immediately preceding application for consideration and must meet all residency requirements during this two-year period.

**62-610—Application for Change of Resident Status.** [SC ADC 62-610]

A. Persons applying for a change of resident classification must complete a residency application/petition and provide supporting documentation prior to a reclassification deadline as established by the institution.

B. The burden of proof rests with those persons applying for a change of resident classification who must show required evidence to document the change in resident status.

**62-611—Incorrect Classification.** [SC ADC 62-611]

A. Persons incorrectly classified as residents are subject to reclassification and to payment of all non-resident tuition and fees not paid. If incorrect classification results from false or concealed facts, such persons may be charged tuition and fees past due and unpaid at the out-of-state rate. The violator may also be subject to administrative, civil, and financial penalties. Until these charges are paid, such persons will not be allowed to receive transcripts or graduate from a South Carolina institution.

B. Residents whose resident status changes are responsible for notifying the Residency Official of the institution attended of such changes.

**62-612—Inquiries and Appeals.** [SC ADC 62-612]

A. Inquiries regarding residency requirements and determinations should be directed to the institutional residency official.

B. Each institution will develop an appeals process to accommodate persons wishing to appeal residency determinations made by the institution's residency official. Neither the primary residency official nor appellate official(s) may waive the provisions of the Statute or regulation governing residency for tuition and fee purposes.

Appeals should be sent to the Student Financial Aid Office, G-01 Sikes Hall.



## DINING SERVICES

The University provides a variety of meal plans to meet student needs. The meal plan dining halls, Harcombe and Schilleter, are on opposite sides of the campus and feature an unlimited seconds policy on most entrees. Students may use their meal card for predesignated meals at the Clemson House. Meals may also be purchased on a cash basis or using a Tiger Stripe account. Meal plans become effective when University housing is opened for occupancy at the beginning of each semester and expire after the evening meal on the day of graduation at the end of each semester. Meal plans are not effective during official University breaks.

The Eastside Food Court, the Canteen, Java City Cyber Café, and Fernow Street Café provide a wide assortment of dining selections on an a la carte, cash, or credit/debit card basis. Nationally branded food concepts are available in cash dining facilities on campus: Burger King and Li'l Dino Subs in the Eastside Food Court, Chick-fil-A at the Union Canteen, and Pizza Hut Express in the Fernow Street Café. All retail dining facilities accept cash, credit/debit cards, and the Tiger 1 Card.

Graduate students may pay for individual meals or choose a meal plan on a semester basis from the following: Any Ten, Plus Any Ten, Any 15, Plus Any 15, Unlimited Access, or Plus Unlimited Access.

Students may change meal plans at the Tiger 1 Card Office in 304 Fike Recreation Center on Mondays. Students may change meal plans at the billing of spring and fall semester fees with no service charge or after the first two weeks and prior to the last six weeks of the semester by paying a \$35 service charge. All adjustments will be prorated, except for students withdrawing from the University. Students may upgrade meal plans during the registration period.

Upperclassmen may terminate their meal plans for any reason. Meal plans cancelled for any reason after service of the first meal will result in a refund of advance payment, minus a \$35 termination charge and a weekly charge for meals available. The meals available charge applies to the meals that have been served, not those that have been eaten by the individual student. The Paw Points which are associated with the Plus plans are not refundable; however, they do carry forward to the next semester. No changes, meal plan cancellations, or refunds will be made during the last six weeks of a semester. Requests for refunds may be made at the Tiger 1 Card Office. Students will be responsible for all service charges related to changes or termination of a meal plan.

## TIGER STRIPE ACCOUNT

The Tiger Stripe account is equivalent to a prepaid debit card. Under this program, funds are deposited into the account along with payment of fees through TigerLine (864-656-8447). As items are purchased from over 200 locations that accept Tiger Stripe, the amount spent is deducted from the account balance. All students are eligible. Additional funds may be added to the account via the Tiger 1 Card Office at [www.tiger1.clemson.edu](http://www.tiger1.clemson.edu). Students may also pay in person at the Tiger 1 Card Office in 304 Fike Recreation Center with cash, check, or credit card; or they may call 864-656-0763 to pay with Visa, MasterCard, or Discover. Office hours are Monday–Friday, 8:00 A.M.–4:30 P.M.

Tiger Stripe accounts are non-refundable except for students withdrawing, graduating, or not returning to the University. Tiger Stripe cannot be used for the payment of tuition. Transactions are limited to \$250 per day in the University Revenue and Receivables Office for the payment of incidental fees. Credit balances at the end of each semester will carry forward to the next term. (Graduate students withdrawing must go to 104 Sikes Hall. Balances greater than \$5 will be refunded.) Any indebtedness to the University will be deducted from refunds. All graduating students will be required to request a refund at the Tiger 1 Card Office two weeks prior to graduation. Any account that remains dormant for 18 months or longer will have the balance transferred to a University scholarship account. For more information, call 864-656-0763 or e-mail [tiger1-1@clemson.edu](mailto:tiger1-1@clemson.edu).



## STUDENT SERVICES

### HOUSING

#### Graduate Student Housing

On-campus housing for graduate students is available with nine- or 12-month lease arrangements. These duplex-style apartments, located on the East Campus in Thornhill Village, each house two graduate students who share the living space, but have private bedrooms.

#### Family Housing

Comfortable and economical housing is available on campus for married and single-parent families. These apartments, located near Clemson House in Douthit Hills, include two- and three-bedroom duplexes and two-bedroom townhouses.

Additional housing information is available from the Housing Office, 200 Mell Hall, Box 344075, Clemson, SC 29634-4075; phone (864) 656-0829.

### REDFERN HEALTH CENTER

#### Medical Services

Redfern Health Center, an outpatient facility, operates Monday–Friday, 8:00 A.M.–5:00 P.M. (summer hours, 8:00 A.M.–4:30 P.M.). Students are seen on an appointment basis or without appointments in the Nurses Clinic. The student health center offers outpatient ambulatory care for illnesses and injury, pharmacy, lab, x-ray, and specialty clinics including women's health and allergy/immunization clinics.

#### After Hours

Emergency 911 services are available after hours. Students with questions about their health care needs should call the NurseLine at 1-888-525-1333. A registered nurse is available by telephone to answer questions and offer advice about health care needs.

Students requiring the care of a physician after hours choose from area emergency rooms and urgent care facilities including Clemson Health Center (an urgent care facility), Oconee Memorial Hospital, Anderson Area Medical Center, Palmetto Baptist Medical Center, and Greenville Memorial Medical Center. Medical costs incurred are the student's responsibility. Students should contact Redfern the next business day for follow-up care.

The University ambulance, staffed with licensed emergency medical personnel 24 hours a day, transports on-campus medical emergencies to the closest community medical resource. Students must pay for off-campus ambulance transportation except for those medical resources within the city of Clemson for after-hours urgent care.

### Counseling and Psychological Services (CAPS)

CAPS provides mental health services for a variety of issues including stress management, depression, anxiety, eating disorders, substance abuse and addictions, relationship violence, and others. All services are confidential. Charges not covered by the health fee are discussed before services are provided. Appointments may be made by calling 656-2451.

CAPS offers a walk-in clinic from 10:00 A.M.–3:00 P.M. so that students can see a counselor as soon as possible. Students are seen on a first-come, first-served basis.

CAPS provides group, individual, and couples counseling and psychotherapy to students. Students who pay the health fee are allowed ten counseling sessions per semester at no charge. Mental health crisis assistance and consultation are available 24 hours a day by calling 656-2451 during regular hours. After hours and on weekends, the on-call counselor can be reached through the University police at 656-2222.

CAPS Lifestyle Substance Abuse Services address the special needs of students and offer early intervention before alcohol or substance abuse becomes a life-long problem. More information is available by calling 656-2451.

CAPS provides psycho-education evaluations for learning and attention difficulties for a charge.

### Health Education/ Alcohol and Drug Education

The Office of Health Education reaches out to the entire campus community and encourages the adoption of healthy lifestyles, general positive attitudes, and the modification of risky health behaviors. In addition, the office selects and trains student peer educators to become healthy role models on campus, engage fellow students in peer counseling, give presentations on health issues relevant to college students, and collect and disseminate information about current health topics to the whole community. The Health Education program covers topics such as alcohol and other drug issues, HIV/AIDS awareness and prevention, sexual health and responsibility, dating violence, healthy sleep lifestyles, nutrition, stress management, and tobacco cessation efforts, among others.

### Financial Considerations

**Health Fee**—University policy requires that all students registered for seven or more credit hours on campus during the fall or spring semester or three or more on-campus credit hours during a summer session pay the University health fee. The health fee provides access to the professional services of University physicians, nurse practitioners, counselors, and health educators at no additional cost; reduced costs for medical diagnostics; and an after-hours urgent care insurance benefit. Students pay for pharmaceuticals, orthopedic equipment, specialty clinics, and psychological testing. Payment is expected at the time of service and may be made by cash, check, MasterCard, Visa, or Tiger Stripe.

**Health Insurance**—See *Mandatory Health Insurance* on page 13.

### CAREER SERVICES

Clemson's Michelin® Career Center offers a variety of services for graduate students, from exploring career options to preparing for full-time positions.

Students can develop personalized career plans by consulting with career counselors. The Career Center also sponsors a graduate Student Career Workshop series, consisting of seminars on preparing résumés, curriculum vitae, and cover letters; honing job searching and interviewing skills; and business and dining etiquette. In addition, the Michelin® Career Center houses a large career library with information on employers, the job outlook, current salaries, as well as many other resources. CareerNet on-line recruiting system is available for students to connect to employers through résumé books, on-campus interviews, and job postings for part-time internships and full-time employment. The Career Fair is held every fall and spring.

Information is available from the Career Center in 316 Hendrix Center, on the Web at [career.clemson.edu](http://career.clemson.edu), or by calling 656-6000.

### DISABILITY SERVICES

Student Disability Services coordinates the provision of reasonable accommodations for students with physical, emotional, or learning disabilities. Accommodations are individualized, flexible, and confidential based on the nature of the disability and the academic environment in compliance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990.

Students are encouraged to consult with the Disability Services staff early in the semester, preferably prior to the first day of class. Current documentation of a specific disability from a licensed professional is needed. Additional information or appointments are available from Student Disability Services, G-23 Redfern Health Center, 656-6848. Details on policies and procedures are available on the Web at [www.clemson.edu/asc](http://www.clemson.edu/asc).



# ACADEMIC REGULATIONS

Academic Regulations can be found on the Web at [www.registrar.clemson.edu/](http://www.registrar.clemson.edu/).

Proper discharge of all duties is required at Clemson University, and a student's first duty is his/her scholastic work. All students should be thoroughly acquainted with these basic requirements.

## PROCEDURES

The following information is not intended as a step-by-step outline of all procedures to be followed, but rather an explanation of primary factors encountered during the process. Detailed information on procedures is available from the academic program offices.

### Major Advisor

A student, with the aid and approval of the department chair or program coordinator, must select a major advisor. This advisor must be a member of the program faculty offering the degree and must meet the requirements for advisory committee membership described below. In departments or programs with large faculties, new graduate students may be assigned a temporary advisor. This advisor recommends and approves courses to be taken during the student's first semester. The coursework selected should be of a fundamental or core nature so the advisory committee will have maximum flexibility to formulate the remainder of the student's program of study.

### Advisory Committee

The student must select an advisory committee in consultation with the department chair or program coordinator. The department's graduate student handbook provides specific information on the process. The advisory committee approves the student's degree curriculum, supervises the graduate program, administers the final oral examination, and initiates the recommendation for the awarding of the degree. In addition, the advisory committee may administer qualifying or preliminary or final comprehensive examinations. One member of the committee is designated as chair or major advisor and normally directs the student's dissertation or thesis, if required.

A minimum of three faculty members are to be selected for a student seeking a master's or specialist's degree, and a minimum of four faculty members are to be selected for a student seeking a doctoral degree. The majority of the advisory committee, including the major advisor, must be comprised of Clemson University faculty who hold full-time, tenure-track positions. Either the major advisor or at least half of the committee must hold rank in the program offering the degree. If a minor is declared, this area must be represented on the committee. Committee members of interdepartmental programs are to be appointed according to bylaws formulated by the program faculty and endorsed by the Graduate School that assure appropriate representation of the participating departments.

Part-time visiting and other nontenure-track faculty employed by Clemson University and faculty emeriti may serve on the committee but may not serve as chair. Persons not employed by the University may serve if they have been appointed to an adjunct faculty status. Part-time, visiting adjunct, and other nontenure-track faculty have full voting status on the outcomes of all examinations given by the committee.

The student, department, and committee members are notified of the fully constituted committee by means of the approved plan of study.

### Plan of Study

A degree-seeking student must file a graduate degree curriculum in accordance with the Enrolled Student Service's timeline. Since fixed curricula normally do not exist for graduate degrees, this planned program represents an individual student's curriculum as recommended by the advisory committee. It must adhere to departmental as well as University policies. Undergraduate deficiencies are designated on the plan of study. Supplemental courses, carrying undergraduate or graduate credit and chosen to broaden the student's academic experience, are not required, but may be listed, on the plan of study. Graduate credit is received only for courses numbered 600 or above. Transfer credit appearing in the curriculum must adhere to the stipulations described in the section entitled *Transfer Credit* which follows. Unless otherwise specified by approved degree programs, course credits used to satisfy the requirements for a bachelor's degree, or its equivalent, may not be used for credit toward a graduate degree.

Before a curriculum is approved, it must be reviewed and signed by the advisory committee. It is then submitted to the department chair and college dean for approval and is forwarded to the Enrolled Student Services Office for approval and distribution.

The form should be filed near the beginning of each student's program of study. Candidates for master's or specialist's degrees should submit the curriculum by the middle of their second semester and doctoral candidates no later than the beginning of their second year of study.

The plan of study may be revised as needed, but the final form must be approved and signed by all committee members and the appropriate department chair. Revised forms must be on file in the Enrolled Student Services Office in the term in which the student plans to graduate.

A \$25 nonrefundable late fee is assessed to a student whose plan of study is submitted after the deadline. The fee increases \$5 per day thereafter (excluding weekends and University holidays).

Students who do not properly file the plan of study risk failing to receive proper advice from their faculty committee members and research or program advisors and may face undue difficulties, including fines or delays in graduating.

## Combined Bachelor's/Master's Plan

Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements.

To be eligible for this plan, students must have completed their bachelor's curriculum through the junior year (minimum 94 credits) and have a minimum overall grade-point ratio of 3.40. Information and application forms are available from the Graduate School Office. Endorsements by the program coordinator or department chair of both programs are required. If accepted, students will be given conditional admission to the master's program pending completion of their bachelor's degrees and submission of satisfactory GRE or GMAT scores, if required. Combined Plan students are not eligible for graduate appointments for financial aid until their Bachelor's degrees have been awarded.

A maximum of 12 credit hours of graduate courses in the master's program may be applied to the bachelor's program. As determined by the participating bachelor's program, graduate courses may be applied to the bachelor's degree as electives or technical requirements or by substitution of 800-level courses for required undergraduate courses. Under no circumstances can 600-level counterparts of courses required in the bachelor's program be counted toward master's requirements.

Not all programs may choose to participate in the Combined Bachelor's/Master's Plan. Those bachelor's programs that do participate may permit fewer than 12 graduate credits to count toward the bachelor's degree. Furthermore, the bachelor's programs determine the acceptability of specific graduate courses to meet their curriculum requirements, and the participating master's programs control admission of students into their programs and their courses. Students should consult individual academic units for specific requirements.

## Dual Master's Degrees

If a student pursues two master's degrees simultaneously, one-sixth of the total graded coursework may be used toward both degrees. The graduate degree curricula must clearly denote that the student is working toward two degrees and identify the courses that are being applied to both programs. Committee members, department chairs, and deans of both graduate programs must approve the two plans of study. At least one committee member should serve on both committees.

## Independence of Graduate Degrees

A graduate student who has completed the requirements for a graduate degree may not then use those same credits toward a second degree.

Courses are offered leading to the research degrees of Master of Arts, Master of Science, and Doctor of Philosophy. In addition, courses are offered leading to the professional degrees of Doctor of Education; Education Specialist; Master of Agricultural Education; Master of Architecture; Master of Arts in Teaching; Master of Business Administration; Master of Career and Technology Education; Master of City and Regional Planning; Master of Construction Science and Management; Master of Education; Mas-



ter of Electronic Commerce; Master of Engineering; Master of Fine Arts; Master of Forest Resources; Master of Human Resource Development; Master of Landscape Architecture, Master of Parks, Recreation, and Tourism Management; Master of Professional Accountancy; Master of Public Administration; and Master of Real Estate Development.

## Continuous Enrollment

Graduate students are expected to pursue their degrees with a minimum of interruption. Students who do not remain continuously enrolled (summers excluded) are subject to the requirements in effect at the time of return.

Only students who are enrolled are eligible to use University facilities and human resources and/or receive any form of financial aid. Students who have completed all required work and who find it necessary to be enrolled during a given semester in order to use facilities or human resources may enroll in G S 799 for a minimum of one credit.

## Dismissal from the Graduate School and Appeal Process

A graduate student may be dropped from the Graduate School at any time for failure to maintain an adequate academic status. Adequate academic status is a 3.0 grade-point ratio in all coursework attempted since admission to the Graduate School, including undergraduate coursework taken as required prerequisites or corequisites, along with satisfactory progress on research, theses, dissertations, or required projects. Notification of dismissal is sent to the student by the Graduate School. A student may appeal if he/she believes that the dismissal was unfair or improper. Notice of intention to appeal must be filed in writing with the Graduate School no later than three days prior to the first day of classes of the next regularly scheduled term, including summer sessions. Appeals are reviewed and/or heard by the Graduate School Continuing Enrollment and Appeals Committee. The committee will meet prior to the first day of classes of the next scheduled term to determine if a reversal of the dismissal decision is warranted.

## CREDIT SYSTEM

### Enrollment Limits

Maximum enrollment limits for graduate students refer to graduate and undergraduate credits combined. If the six-week and three-week sessions run concurrently, the total credits are not permitted to exceed the maximum for the six-week session.

Quarter-time, half-time, and three-quarter-time graduate assistants are defined as those who contribute a weekly average of 10, 20, and 30 clock hours service, respectively, to the University for the entire semester. A full-time employee is defined as anyone employed five full working days per week regardless of the employer. A graduate student who becomes employed full time while an assistantship is in force must notify the Graduate School and the department providing the assistantship. Graduate students paid solely on an hourly basis are not classified as graduate assistants but are subject to the same limitation in credit loads described above.

### Enrollment Limits Maximum Credit Hours

Student Category	Semester	6-week Session	3-week Session
Full-time students	18	6	3
Graduate assistants (1/4 time)	15	5	3
Graduate Assistants (1/2 time)	12	4	2
Graduate Assistants (3/4 time)	12	3	1
Full-time Employees	9	3	1

## Transfer Credit

To have courses considered for transfer, students must have a transcript sent from the institution(s) at which credit was earned to the Enrolled Student Services Office. No more than one-third of the graded coursework required for a master's degree may be transferred from an accredited institution. For the doctoral degree, as many as 48 credit hours of coursework may be transferred. In all cases, the use of transfer credits must be recommended by the student's advisory committee and approved by the department. Under no circumstances will transfer credit be awarded for research, internship, courses graded on a pass/fail basis, or courses in which a grade lower than B, or its equivalent, has been received. Grades earned for courses taken at institutions other than Clemson University will not be included in the student's grade-point ratio.

Credits may be transferred for work completed at off-campus centers of accredited institutions, provided such courses are acceptable, without reservation, in degree programs at those institutions. No credit will be given for continuing education units, correspondence, extension, or in-service courses or for concentrated courses and workshops that award credit at a rate exceeding one credit per week.

All transfer credits must be verified by an official transcript from the institution at which the work was completed. Coursework completed outside the six-year time limit may not be transferred to Clemson University or validated for graduate credit. Valid transfer credits will appear on the student's transcript as credits earned.

## GRADING SYSTEM

In calculating a student's grade-point ratio, the total number of grade points accumulated by the student is divided by the total number of credit hours attempted at Clemson during the semester, session, or other period for which the grade-point ratio is calculated. For each credit hour, the student receives grade points as follows: A-4, B-3, C-2. No grade points are assigned for grades D, F, I, P, or W.

Most graduate courses are graded on an A-B-C-D-F scale. Thesis and dissertation research and several other graduate courses are graded on a pass/fail (P/F) basis. Courses graded pass/fail are not included in the academic average; however, the grade P or F is placed on the student's permanent academic

record. Only credit hours for which a grade of P is achieved apply toward the number of credit hours required for the degree. The accumulation of grades of pass in thesis or dissertation research does not imply completion of the research; such grades indicate satisfactory progress.

A minimum grade of C on all coursework must be made for the course to apply toward a degree. Graduate students must maintain a cumulative B average (3.0 grade-point ratio) in all graduate-level courses (600-level or above). In addition, graduate students must maintain an overall cumulative B average in all courses (undergraduate and graduate) since admission to the Graduate School, excluding those taken on a pass/fail basis. Finally, the student must maintain a B average in all courses listed the plan of study. Students who fail to meet these requirements become ineligible for graduation and are placed on academic probation. The probationary status will remain in effect until nine additional semester hours of graduate credit have been earned. Students who fail to remove the probationary status as prescribed are subject to academic dismissal and will not be permitted to continue in the Graduate School without the recommendation of the program coordinator and written approval of the Graduate School. Withdrawal from a course while on probation will not be allowed unless prior approval is obtained from the Graduate School. Any unauthorized withdrawal will be considered as unsatisfactory academic performance.

The cumulative B average requirements apply independently to graduate degrees. That is, a new grade-point ratio computation begins after completion of the first degree; however, when a doctoral degree is pursued after completion of a master's degree in the same major, the grade-point ratio computation continues for both degrees.

A transcript will reflect grades from courses repeated for required credits.

## Enrollment on a Pass/Fail Basis

The only graduate courses that may be taken on a pass/fail basis are thesis and dissertation research and a small number of unstructured courses in which the pass/fail grading system appears in the course description.

## Auditing

Permission to audit a graduate course is at the discretion of the academic department chair, the coordinator of the program offering the course, or the instructor. Principal factors involved in granting permission are that the auditor must have the necessary academic background and space must be available.

Audited courses do not carry credit and are not noted on the student's academic record. Auditors are not required to take tests or examinations; however, the instructor, at his/her discretion, may require or deny the auditor's participation in class to whatever extent deemed desirable.

A graduate student may not satisfy by audit a stated prerequisite for a graduate course. Additionally, a graduate student may not establish credit through examination in any course for which he/she was previously registered as an auditor.



## Incomplete Graduate Coursework

Except for courses numbered 891 and 991, a grade of *I* (incomplete) may be given for any graduate course in which work remains unfinished and the student is unable to fulfill all requirements because of circumstances beyond his/her control. This grade is not given in lieu of unsatisfactory or failing grades received for completed courses for the purpose of improving the grade later. The incomplete grade is calculated as an *F* in the student's grade-point ratio until the work is made up and a final grade is assigned.

At the student's request, the instructor shall provide a written statement of the work to be completed.

The grade of *I* will be valid in normal lecture or laboratory courses for 30 days after the beginning of the next scheduled session, excluding summers and irrespective of the student's enrollment status. Within this period, the student must complete the work or obtain an extension, approved by the instructor and chair of the department responsible for the course, stating the reason for the request and the length of time needed. Normally, only one request for an extension for each grade of *I* will be granted.

Students receiving a grade of *I* in unstructured, independent study courses as designated by the Graduate School must complete all work and receive a final grade within one calendar year. At the discretion of the instructor, the deadline for removal of these incomplete grades may be less than one year.

A graduate student will not be permitted to repeat any portion or reregister for any course for which the grade of *I* has been given. If all work is not completed by the appropriate deadlines, a grade of *F* will be recorded on the student's academic record.

Students who receive a grade of *I* while enrolled in the Graduate School remain ineligible for graduation until the incomplete work has been made up and a letter grade submitted to Registrar's Office.

Instructors have ten working days after the deadline to grade the make-up work and submit the final grade to the Registrar's Office. Work submitted by the student after the printed deadline should not be accepted by the instructor unless an extension has been approved. Requests for extensions, like the make-up work, should be submitted by the deadline printed on the make-up card. Grades of *I* that remain after the ten-working-day period will be converted automatically to *F*.

## Dropping Coursework

The academic calendar provides official dates for withdrawing from a class without record or without final grades. Withdrawal from graduate coursework is strongly discouraged. Students who officially withdraw within the first two weeks of classes will have no grades recorded. Those who officially withdraw after the first two weeks and prior to the last seven weeks will have a grade of *W* (withdrew) entered on the academic record.

International graduate students must receive authorization for course withdrawals from an advisor in International Programs and Services. It is important that international students not fall below the required full-time enrollment mandated by the Bureau of Citizenship and Immigration Services.

If the student's academic advisor does not approve the course withdrawal, the student may appeal to the department chair. A refusal by the department chair may be appealed to the Dean of the Graduate School. The date on which the student withdraws on-line is the official date of withdrawal recorded by the registrar.

Failure to attend classes or verbal notification to instructors does not constitute withdrawal. Students must drop a course as described above or be credited with a failure. Students must use the on-line registration system to withdraw from a course.

## COURSEWORK

### Restrictions

To enroll in or receive credit for any courses at the 600-level or above, the student must have been officially admitted by the Graduate School, either to a degree program or as a nondegree student, or must have been granted conditional acceptance.

Students may not enroll in 600-level courses for which undergraduate credit has been awarded, nor can graduate credit be awarded retroactively for undergraduate courses already completed.

### First Day Class Attendance

All students are required to attend the first scheduled day of classes and labs. Students who cannot attend the first class are responsible for contacting the instructor to indicate their intent to remain in that class. If a student does not attend the first class meeting or contact the instructor by the second meeting or the last day to add, whichever comes first, the instructor has the option of dropping the student from the roll.

### Class Syllabus

A syllabus will be prepared for every graduate class and made available to students no later than the last class period before the last day for a student to add a class. The syllabus should give the course expectations, including topical outline of the course, grading policies and attendance policies.

### Seniors

Enrollment of Clemson University seniors in any graduate course is subject to approval by the department offering the course and the Graduate School. Approval is required prior to registration. Approval forms are available from the Graduate School Office in E-106 Martin Hall or on the Web at [www.grad.clemson.edu/uf\\_general.html](http://www.grad.clemson.edu/uf_general.html). The total course workload for the semester must not exceed 18 hours, and the cumulative graduate credits earned by seniors shall not exceed 12 semester hours.

Seniors with a cumulative grade-point ratio of 3.0 or higher may enroll in 700- or 800-level courses and may use these courses to meet requirements for the bachelor's degree; however, courses used for this purpose cannot be counted later toward an advanced degree. Alternatively, such students may take 600-, 700-, or 800-level courses in excess of the requirements for their undergraduate degrees and may request that these courses be included as a part of their graduate program if they are subsequently admitted to the Graduate School. Courses cannot be taken at the 600 level if their 400-level counterparts are re-

quired for the undergraduate degree in the same academic major as the proposed graduate degree.

A Clemson senior with a cumulative grade-point ratio less than 3.0 may apply to the Graduate School for conditional acceptance. If accepted, the student may enroll in graduate courses for inclusion in a future graduate program, subject to approval of Form GS6. The form must be turned in and accepted by the Graduate School before a student can register for graduate courses.

The credits and quality points associated with senior enrollment in graduate courses will be part of the undergraduate record.

## MASTER'S DEGREE REQUIREMENTS

### Coursework

The total number of graduate credits required for the degree is determined by the student's advisory committee, consistent with the specific program guidelines and Graduate School policy. These credits constitute the core of the student's graduate degree curriculum. Supplemental courses, carrying undergraduate or graduate credit and chosen to broaden the student's academic experience, are not required on the plan of study; however, if a listing is desirable, such courses may be included.

The Graduate School requires that each degree program consist of a minimum of 30 hours of graduate credit with at least 12 credit hours, exclusive of master's thesis research (891), in the major discipline as defined by the advisory committee, subject to degree program regulations. A minor outside that degree program, if chosen, shall consist of at least six credit hours in that area. The following conditions must also be observed:

**Master of Arts or Master of Science (Thesis Option)**—Each program includes a minimum of 24 hours of graduate credit and six hours of master's thesis research (891). At least one-half of the total graduate credit hours required by the advisory committee, exclusive of thesis research, must be selected from courses numbered 800 or above.

**Master of Arts or Master of Science (Nonthesis Option)**—Each program includes a minimum of 30 hours of graduate credit, none of which may be master's thesis research. At least one-half of the total graduate credit hours required by the advisory committee must be selected from courses numbered 800 or above.

**Professional Master's Degrees**—Each program includes a minimum of 30 hours of graduate credit. Except for professional programs in the College of Architecture, Arts, and Humanities that require a thesis, research credits (891) may not be included in the program requirements. Any additional requirements for these degrees are described under the colleges which offer the degrees.

### Theses

Candidates for master's degrees receive academic credit for conducting research and preparing a thesis under the direction of the research advisor. In those Master of Arts or Master of Science degree programs requiring a thesis, six credits of research



(891) are required. The thesis option curricula in the Master of Architecture, Master of City and Regional Planning, and Master of Fine Arts degree programs require 15, 6–9, and 15 credits of research, respectively.

The accumulation of grades of *Pass* in thesis research does not imply completion of the research, but only indicates satisfactory progress.

### Off-campus Research

Although thesis research is normally performed at Clemson, in some cases the University may not have on its campus certain specialized equipment or facilities that would be desirable for advanced training at the master's level. In this case, permission may be granted for off-campus research. The requirements to be satisfied in such cases are identical to those listed for the doctoral degree (see below), with the exception that the off-campus research supervisor need not hold the PhD degree, provided he/she is qualified and certified for the supervisory position by the department and college involved and by the graduate dean.

### Residence for Master's Degree

There is no University-wide residence requirement for a master's degree; however, individual degree programs may establish such a requirement.

### Time Limit

A master's student has six years to complete a degree; therefore, all coursework to be credited toward any master's degree must have been enrolled in and completed within six calendar years prior to the date on which the degree is to be awarded. When recommended by the student's advisory committee and approved by the Graduate Dean, as many as six credit hours of coursework at Clemson University, completed outside the six-year limit, may be validated by a written comprehensive examination based on the latest syllabus and course content. Independent study courses are not subject to validation. Coursework completed outside the six-year time limit at an institution other than Clemson University may not be transferred to Clemson or validated for graduate credit.

### Foreign Language

A reading knowledge (the equivalent of two years of study at the college level) of an approved foreign language is a departmental requirement for certain Master of Arts and Master of Science degrees. Languages commonly accepted are French, German, Spanish and, in some cases, Russian or a classical language.

The requirement may be satisfied by completing a course in the approved language through 202 (or equivalent) with a B or better or by passing French, German, or Spanish 151. The requirement must have been completed within six years prior to the student's finishing the graduate degree. Upon the recommendation of the Chair of the Department of Languages, knowledge of another language may be approved if adequate justification can be presented that the language is not native to the student and that a proper testing procedure can be established. Any expense incurred in obtaining assistance for such testing is the responsibility of the student.

The Department of Languages also administers a foreign language translation test three times annually. Applications, available in the Department of Languages, must be filed at least three weeks before the test date.

### Final Master's Examination

Each candidate for the master's degree, after completion of the thesis, if required, and at least three weeks before the degree is to be awarded, must pass a final examination. The examination may be oral and/or written and is administered by the advisory committee or a standing committee appointed in accordance with published program policies.

Members of the faculty, as well as members of the Graduate Curriculum Committee and the Dean of the Graduate School, are invited to attend the examination. Within five days after the examination, the examining committee, through form GS7, will notify the Graduate School of the results of the examination. A student who fails a final examination may be allowed a second opportunity only with the recommendation of the advisory committee. Failure of the second examination will result in dismissal from the Graduate School. A majority decision is required; dissenting members of the examining committee may forward a minority report to the Graduate School.

## SPECIALIST IN EDUCATION DEGREE

The requirements pertaining to residence, time limits, and final examinations for master's degrees also apply to the Specialist in Education degree. Coursework required includes 30 credit hours beyond the master's degree. See page 64 for program details.

## DOCTOR OF PHILOSOPHY AND DOCTOR OF EDUCATION DEGREE REQUIREMENTS

### Coursework

Work leading to the Doctor of Philosophy degree is planned to give the student a comprehensive knowledge of his/her field of specialization and a mastery of the methods of research. The degree is not awarded solely on the basis of coursework completed, residence, or other routine requirements. The final basis of granting the degree is the student's grasp of the subject matter of a broad field of study, competence in planning and conducting research, and ability to express him/herself adequately and professionally orally and in writing. In addition, the candidate for the Doctor of Education degree must arrange with the advisory committee to engage in an internship appropriate to his/her field of professional service.

The advisory committee aids the student in developing a degree curriculum which includes the selection of specific courses and their sequence. Although no minimum coursework requirements exist for the doctoral degree, committees are encouraged to require courses other than those that directly support the dissertation research. Work in the minor field or fields, if required, normally comprises 12–24 hours in courses carrying graduate

credit. A minimum of 18 hours of doctoral research is required. Should the direction of study or research interest change, the student may request the appointment of a new advisor.

### Dissertations

Candidates for doctoral degrees receive academic credit for conducting research and preparing a dissertation under the direction of the research advisor. A dissertation, mandatory for all candidates for the PhD or EdD degrees, requires 18 credits of doctoral research (991) exclusive of any research credits earned at the master's level.

The accumulation of grades of *Pass* in dissertation research does not imply completion of the research, but only indicates satisfactory progress.

### Residence for Doctoral Degree

Residence is a necessary concept in graduate education, particularly in the preparation of the dissertation. The purpose of residence is to require the student to spend a specified minimum amount of time in direct personal association with members of the faculty of the University and under direct tutelage and advisement of a research advisor and advisory committee in the department or program of the major; and participating in other normal activities pertinent to graduate education such as seminars and close association with other student researchers.

To receive the Doctor of Philosophy degree, the student must complete at least 15 hours of graduate credit including research credit hours (991) on the Clemson University campus in a continuous 12-month period.

For students employed substantially more than half time, a statement specifying the manner in which the residence requirement is to be satisfied shall be formulated by the advisory committee and included in the graduate degree curriculum. Also, upon completion of the final examination, the student's committee will forward to the Graduate School a statement approved by the department chair and college dean certifying that residence requirements have been met.

Exceptions to this requirement may be granted by the Dean of the Graduate School. Major advisors seeking an exemption to this policy must submit an academic plan for the student that is signed by the major advisor and the department chair.

### Time Limit

Because no minimum coursework requirements exist for the Doctor of Philosophy degree, the time limitation for completion is determined by the dates by which essential components of the degree are completed. The following must be passed in the five-year period prior to graduation: comprehensive examination; foreign language examination, if required; defense of dissertation; and approval of dissertation by the Graduate School.

### Foreign Language

Certain doctoral programs include a foreign language requirement. A reading knowledge (the equivalent of two years of study at the college level) of an approved foreign language is expected. Languages commonly accepted are French, German, Spanish and, in some cases, Russian or a classical language.



The requirement may be satisfied by completing a course in the approved language through 202 (or equivalent) with a B or better or by passing French, German, or Spanish 151. The requirement must have been completed within five years prior to the student's finishing the graduate degree. Upon the recommendation of the Chair of the Department of Languages, knowledge of another language may be approved if adequate justification can be presented that the language is not native to the student and that a proper testing procedure can be established. Any expense incurred in obtaining assistance for such testing is the responsibility of the student.

The Department of Languages also administers a foreign language translation test three times annually. Applications, available in the Department of Languages, must be filed at least three weeks before the test date.

### Off-campus Research

Doctoral research may be conducted away from the Clemson University campus under special circumstances. (See *Research Opportunities* in the section entitled *Graduate School*.) If such research is to be performed under the immediate direction of a Clemson University faculty member acting as dissertation advisor and supervisor, the following additional requirements will be made:

*Written consent and research plan*—The student must have the written consent of his/her dissertation advisor, full advisory committee, department chair, college dean, and the graduate dean. Prior to departure from campus, the student must submit a written plan for the research effort to the advisory committee for approval. The plan should include a discussion of the problem and intended scope of the investigation and should be structured in terms of a specific time frame.

*Statement from the organization where research will be conducted*—The advisory committee may require a statement from an appropriate officer of the organization at which the student will be located agreeing to the student's plan to complete dissertation research using the organization's equipment and facilities; the apportioning of at least 25 percent or other appropriate amount of the student's employment hours to dissertation research; the organization's release of patent rights or copyrights arising from discoveries or concepts that evolve during the course of the student's doctoral research.

*Travel*—The student may be required to travel to the Clemson campus, not at the expense of the University, to meet with the dissertation advisor and advisory committee as often as the committee deems necessary.

*Continuous Enrollment*—The student must maintain continuous enrollment at Clemson University while the research is in progress. It is the student's responsibility to make suitable arrangements with the department to maintain this continuous registration. Normally the student will not be required to register for summer sessions; however, he/she must be registered for the term that involves the review of the completed dissertation and/or the final examination.

*Supervision and Reports*—When doctoral research is conducted away from the Clemson campus and under the immediate direction of a dissertation supervisor who is employed by an organization other than Clemson University, in order to accommodate the student as well as to exercise proper and necessary control over this important phase of doctoral study, the following requirements must be met:

(a) An employee, having earned a PhD and being engaged in the general subject area of the student's research, must be designated by an officer of the organization to supervise the student's research;

(b) The employee must be recommended to the provost by the appropriate college dean for appointment as an adjunct professor of Clemson University;

(c) A résumé of the research supervisor must be submitted to the student's full advisory committee for review and recommendation to the Dean of the Graduate School;

(d) The research supervisor must submit a final statement regarding the dissertation research, as well as interim reports, if the committee deems such necessary; and

(e) The off-campus research supervisor cannot serve as the student's major advisor.

### Qualifying Examinations

Some doctoral programs require preliminary or qualifying examinations prior to the comprehensive examination. The structure, duration, review, and re-examination policies for these examinations are defined in writing by the program faculty and are available from the program coordinator. A copy of these policies is also to be filed with the Graduate School.

### Comprehensive Examinations

Prior to taking the comprehensive examination before admission to candidacy, all doctoral students must select an advisory committee and file an approved graduate degree curriculum with the Graduate School.

Satisfactory completion of the comprehensive examination must occur no less than six months and no more than five years prior to the date of graduation. For examinations consisting of several parts (for example, a written plus an oral, or a written in cumulative format), the date of completion will coincide with the date of the last examination activity. The time span from the beginning to the end of the examination, however, must not exceed 12 months. Failure of any portion that negates further examining will be reported as a failure of the examination. The student has five calendar years after the date of the completion of the comprehensive examination to complete all other degree requirements. A student who completes all the degree requirements will be invited to participate in the next scheduled graduation ceremonies.

Students may attempt the comprehensive examination only on the recommendation of their advisory committees after completion of most of the required coursework. This examination must be administered by the Clemson University program faculty offering the degree. The examining committee may be the student's advisory committee or a

standing committee appointed according to published program policies. A majority decision is required; dissenting members of the examining committee may forward a minority report to the Graduate School. The chair of the advisory committee will inform the Graduate School of the result, via form GS5, within three weeks of the examination. The student's performance on this examination will determine whether he/she will be recommended for admission to candidacy for the degree.

Should the student fail to pass the comprehensive examination, he/she may be given a second opportunity if so recommended by the examining committee. A second failure shall result in the student being declared ineligible to receive the Doctor of Philosophy degree at Clemson University.

### Final Doctoral Examination

The candidate for the Doctor of Philosophy degree must pass a final oral examination (dissertation defense) at least three weeks prior to the commencement at which he/she plans to obtain the degree. The examination will be administered by the student's advisory committee. Members of the faculty, as well as members of the Graduate Curriculum Committee and the Dean of the Graduate School, are invited to attend the examination.

A student who fails a final oral examination may be allowed a second opportunity only with the recommendation of the advisory committee. Failure of the second examination will result in dismissal from the Graduate School.

## GRADUATION REQUIREMENTS

A candidate for graduation is a student who has submitted a completed diploma application by the deadline prescribed in the University calendar for a particular graduation date.

### Enrollment

Students who have completed all coursework, examinations, projects, and thesis or dissertation requirements and have obtained approval from the Graduate School on the final copy of the thesis or dissertation need not be enrolled in any credits to graduate or participate in the graduation ceremony.

Students who need to utilize University resources (library, advisors and faculty, laboratories, etc.) to complete requirements during the semester prior to graduation must enroll in at least one credit hour. Graduate assistants completing a final semester of research or teaching assignments must enroll in at least nine semester hours to maintain their assistantships. Students may register for GS 799 to help meet the requirements of this final enrollment.

Students should contact the Enrolled Student Services Office early in the calendar year in which they plan to graduate to confirm their graduation status.

### Comprehensive Examination for Doctoral Degree (form GS5)

The GS5 form is filed by a doctoral student's examining committee, which may or may not be constituted of the same people serving on the advisory committee. This form should be filed with the Enrolled



Student Services Office in 104 Sikes Hall no later than three weeks after the examination and at least six months prior to graduation.

### Candidacy for the PhD Degree

Admission to the Graduate School does not qualify a student as a candidate for an advanced degree. Candidacy is granted when the examining committee submits form GS5 indicating the successful completion of the comprehensive examination.

Students desiring admission to candidacy must have full status admission to the Graduate School, satisfactory academic standing, and an approved graduate degree curriculum on file.

### Defense of Thesis/Dissertation and/or Final Written Master's Examination (form GS7)

Form GS7 is submitted to the Enrolled Student Services Office by the chair of the student's thesis or dissertation committee and indicates if the student has successfully passed the oral defense. Notification to the Graduate School of the results of the defense must be filed by the chair of the committee within five days of the defense.

Form GS7 is also used to indicate that a student has successfully passed a written final exam for a master's degree in those departments where such examinations are conducted. In this instance, the chair of the examining committee must submit the GS7 form to the Enrolled Student Services Office within five days of the completion of the exam.

### Duplication of Higher Degrees

A student holding a master's degree or doctoral degree may not as a rule become a candidate for the same degree in the same field of study.

## THESES AND DISSERTATIONS

### Review (form GS32)

The Graduate School has delegated authority to students' advisory committees to determine the appropriate format for publication of theses and dissertations in accordance with standards acceptable to the discipline. Consequently, the Graduate School has published limited but specific guidelines for students to use in formatting their theses and dissertations. These guidelines are available on the Web at [www.grad.clemson.edu](http://www.grad.clemson.edu).

The research advisor determines when the manuscript is suitable for initial review by the remaining committee members. Guidelines for the review process and a thesis/dissertation review form are available in the departments and the Graduate School. These guidelines are designed to produce a timely review by each committee member and to provide a measure of protection for all parties against problems resulting from lack of communication and/or attention. If the student requests, the research advisor is obligated to initiate the thesis/dissertation review form and forward it to the remaining committee members along with the manuscript. The research advisor must be familiar with departmental practices regarding the quality of the manuscript at the various review stages and of the wishes of

the department chair, as an ex-officio committee member, to exercise the option of approving the thesis or dissertation in its final form.

The student, in consultation with his/her major advisor, shall provide each advisory committee member with a copy of the manuscript for initial review. This action should take place well in advance of, and not less than three weeks prior to, the final examination and defense of the thesis or dissertation. Students must prepare the manuscript in a publication style acceptable to the advisory committee. When the manuscript is approved by the advisory committee, the thesis or dissertation is presented to the Graduate School for final review and signature prior to duplication.

Committee members should normally complete the initial review in three weeks or less. Provisions of the guidelines, however, allow for additional time if necessary. Failure of a committee member to complete the initial review within six weeks may result in his/her replacement, provided the student has requested use of the thesis/dissertation review form. A second review after revisions should be completed in one week, with provisions being available for additional time.

It should be understood that a vote to pass a student on his/her performance at the thesis/dissertation defense (form GS7) does not imply final approval of the thesis or dissertation. Approval of the thesis or dissertation is given by faculty signing the approval page. The approval page should not be signed by the committee until the student has made all revisions as instructed by the committee.

### Graduate School Format Approval

The Graduate School will review the thesis or dissertation to ensure that it complies with the guidelines established by the Graduate School for formatting the preliminary pages of the document, including the margins. The Publications staff will conduct its review of the document only after the student's committee chair signs form GS32 indicating that the document is prepared in a publication style acceptable to the discipline and all members of the student's committee have signed the approval page.

Students must bring a signed GS32 form as well as a copy of the thesis/dissertation to the Graduate School. Students are notified when the review is complete. Manuscripts will be signed by the Graduate School only when no changes are required. Typically theses and dissertations are reviewed within one or two days of receipt by the Graduate School. Manuscripts will not be reviewed the same day they are submitted.

### Thesis/Dissertation Binding and Mailing

Following approval of the thesis or dissertation by the Graduate School, the student must pay fees associated with publication to University Revenue and Receivables in G-08 Sikes Hall.

Three copies of the thesis or dissertation, printed or photocopied on appropriate paper, are required for binding. These copies must be submitted to the Cooper Library by the deadline. Complete binding guidelines are on the Web at [www.lib.clemson.edu/binding](http://www.lib.clemson.edu/binding).

For doctoral candidates, a fourth copy of the dissertation is required for microfilming and is placed with University Microfilms, Inc. of Ann Arbor, MI. An additional copy of the approval page, title page, and abstract must also be submitted, with the abstract not exceeding 350 words. Additional information is available from the Graduate School.

Cooper Library is responsible for binding theses and dissertations and for distributing them according to information supplied on the Thesis/Dissertation Binding and Mailing Form.

### Restrictions on Use of Theses and Dissertations

Unpublished theses and dissertations submitted to the Graduate School in partial fulfillment of the requirements for graduate degrees and deposited in the University library are, as a rule, open to the public for reference purposes. However, extended quotations or summaries may be published only with the permission of the author and the graduate dean.

### Publication Policy

It is expected that the results of research performed using University facilities be published in the open literature (i.e., theses, dissertations, journals, magazines, or books) and that any information obtained may be freely disclosed by the faculty in the teaching programs of the University.

Exceptional cases may arise, however. The guidelines below shall apply to any sponsored projects requiring that results be kept confidential.

1. The University shall not accept awards that require research results to be kept confidential forever. A definite term of confidentiality shall be stated in a written nondisclosure agreement and shall not exceed one year beyond the date of notification to the sponsor that a manuscript suitable for publication has been prepared. Exceptions may be granted by the University administration only under unusual circumstance (e.g., national security, national emergency, classified activities, or certain confidential agreements).
2. Students associated with confidential projects must have prior approval for the use of results in preparing reports, theses, or dissertations in fulfillment of degree requirements. The Graduate School will normally not accept a thesis or dissertation that must be held in confidence for more than one year. Documents submitted in partial fulfillment of degree requirements will be retained by the Graduate School (or the department in the case of project reports for nonthesis programs) in accordance with the nondisclosure agreement. The student's thesis or dissertation defense shall not be open to those not bound by the nondisclosure agreement.

### Awarding of Graduate Degrees Posthumously

A graduate student meeting the following minimum requirements may be awarded a degree posthumously on the recommendation of the faculty of the college concerned:

- the student had at least a 3.0 grade-point ratio at the time of death



- he/she and a plan of study on file and would have qualified for graduation at the end of the semester or summer session during which death occurred

The chair of the department, through the dean of the college, should submit a letter to the dean of the Graduate School requesting this action.

## ACADEMIC RECORDS

The student's permanent academic record is maintained in the Registrar's Office and contains personal identifying information, grades, and credits. Where appropriate, statements of a corrective nature, withdrawals, suspension for failure to meet academic standards, suspension for disciplinary reasons, and graduation data are added. The academic record is a historical record of the student's academic progress.

### Change of Degree Program

A student who has enrolled in a degree program within the past two calendar years may request a change of major and/or degree without submitting a new application. The student must submit form GS14, available from the Enrolled Student Services Office in 104 Sikes Hall, approved by the department chair or chair of the program. All program and Graduate School requirements must be met before final approval will be granted.

### Academic Renewal

A student who was dismissed from the Graduate School for a grade-point deficiency and who has not enrolled for a period of two or more academic years may apply for readmission under special conditions known as academic renewal. Under these conditions, the previous graduate credits attempted and quality-point deficit will not constitute a liability in a new grade-point computation; however, no credits passed or their attending quality points will be available to the student for a degree at Clemson, and any courses previously passed may not be validated by special examination. The previous record will appear on the permanent record as well as the notation of readmission under the policy of academic renewal.

### Transcripts

Official transcripts are issued only at the authorized, written request of the student. Requests are directed to Transcripts, 104 Sikes Hall, Box 345125, Clemson, SC 29634-5125. Payment in advance is required and may be made by Discover, MasterCard, Visa, Tiger Stripe, check (payable to Clemson University), or cash. The following must be included with the transcript request: full name (including any names used while at Clemson), social security number, current address, date of birth, date the student last attended Clemson, where the transcript is to be sent, and payment of \$5 per transcript. Telephone requests will not be honored. Transcript requests are normally processed within 48 hours, but additional processing time may be required at the end of a semester. Information is available from the Enrolled Student Services Office at the address above or by telephone at 864-656-2173. Official transcripts are not issued for those who are indebted to the University.

## ACADEMIC INTEGRITY

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

### I. Academic Integrity Policy

A. Any breach of the principles outlined in the Academic Integrity Statement is considered an act of academic dishonesty.

B. Academic dishonesty is further defined as:

1. Giving, receiving, or using unauthorized aid on any academic work;
2. Plagiarism, which includes the copying of language, structure, or ideas of another and attributing the work to one's own efforts;
3. Attempts to copy, edit, or delete computer files that belong to another person or use of Computer Center account numbers that belong to another person without the permission of the file owner, account owner, or file number owner;

C. All academic work submitted for grading contains an implicit pledge and may contain, at the request of an instructor, an explicit pledge by the student that no unauthorized aid has been received.

D. It is the responsibility of every member of the Clemson University community to enforce the Academic Integrity Policy.

### II. Academic Integrity Committee

The use of the title "Dean" refers to the Dean of the Graduate School, the Associate Dean of the Graduate School, or a designated appointee. Furthermore, the power to hear cases of academic dishonesty is vested in an Academic Integrity Committee.

#### A. Structure

The Academic Integrity Committee is composed of seven members as follows:

1. Five tenured members of the faculty; one member from each college elected by their respective collegiate faculties. Faculty members will be elected, serving for a period of two years. Terms commence with the fall semester.
2. Two members of the graduate student body are nominated by the Graduate Student Body President, through an application and interview process in the spring semester, approved by the Graduate Student Senate, and appointed by the provost for terms of no more than two years. Students must have a 3.0 grade-point ratio at the time of appointment and must have completed nine hours by the end of the spring semester. Nominations will be made in the spring semester with terms of service commencing with the fall semester.
3. The committee consists of one standing board, hereafter referred to as a hearing board, which will hear the cases of academic dishonesty. The hearing board convenes when there is a case to be heard. For summer sessions, the Dean must maintain a hearing board to hear cases.

4. The hearing board is comprised of a faculty member from each college and two students. Quorum, for a hearing board, is one student, two faculty members, and the chairperson. Decisions by the hearing board will be by majority vote.

5. The chairperson will be elected from within the Committee's membership. The chairperson is a voting member of the Committee.

6. Before hearing any cases, a new member of the committee must undergo a training session with the Dean of the Graduate School.

7. The Dean is the administrative coordinator of the Academic Integrity Committee.

#### B. Procedures

The use of the title "Dean" refers to the Dean of the Graduate School, the Associate Dean of the Graduate School, or a designated appointee.

1. When, in the opinion of a faculty member, there is evidence that a student has committed an act of academic dishonesty, the faculty member shall make a formal written charge of academic dishonesty, including a description of the misconduct, to the Dean. At the same time, the faculty member may, but is not required to, inform each involved student privately of the nature of the alleged charge.

2. When, in the opinion of the student, there is evidence that another student has committed an act of academic dishonesty, he/she should contact the faculty member for the course to discuss the incident. After being contacted, if, in the opinion of the faculty member, there is evidence that a student has committed an act of academic dishonesty, the faculty member shall make a formal written charge of academic dishonesty, including a description of the misconduct, to the Dean. At the same time, the faculty member may, but is not required to, inform privately each student involved of the nature of the alleged charge.

3. When the Dean has received a formal charge of an alleged violation, he/she will contact privately the student involved to notify him/her of the charge and at the same time will provide the student with a copy of the charge and a copy of the procedures that the Academic Integrity Committee has adopted, pursuant to number 6 below.

4. The Dean will convene the board of the Academic Integrity Committee within 14 calendar days of informing the student of an alleged violation. All students will be presumed innocent of a violation until found guilty by a hearing board.

5. A charge of academic dishonesty in a course must be made within 14 calendar days of the date printed on the grade report for the semester or session in which the course is completed. If an *I* (Incomplete) is given in a course, the grade in the course is considered to be final when the *I* is made up.

6. The Academic Integrity Committee will adopt its procedures prior to the first case heard by a hearing board. In addition to providing the student with a copy of the procedures, as stated in number 3 above, the Dean will provide a copy of the procedures to the involved faculty member and also the hearing board members. The Dean will also retain copies of these procedures. The procedures must afford both faculty and students the opportunity to present their cases and the opportunity for rebuttal.



7. In cases in which there is a finding of guilt, the faculty member may consult with the Dean to consider any past precedent established regarding academic penalties levied in similar cases. Faculty members must inform the Dean of the academic penalty for a student found guilty by a hearing board.

8. The Dean is responsible for notifying the registrar and all other appropriate University personnel of the finding of guilt and the academic penalty. The Dean retains all records of academic dishonesty cases and their findings in accordance with the University's Records Retention Policy.

### C. Penalties

1. Upon a finding of "not guilty" by a hearing board, all records relating to the charge will be destroyed.

2. Upon a finding of "guilty" by a hearing board, the Dean will notify the student and faculty member of the decision immediately. If the offense is the first for the student, then the faculty member has the ability to determine the academic penalty, which shall not exceed a grade of *F* for the course.

3. If the finding of guilt is not the student's first offense, the student will receive a grade of *F* for the course, will be suspended from the University for one or more semesters, and may be permanently dismissed from the University. The hearing board will determine the period for which the student will be suspended or, if applicable, permanently dismissed. Suspension or dismissal requires the notification of the President of the University.

4. Upon a finding of "guilty" by a hearing board, additional penalties may be imposed by the department or program, for those students enrolled in a degree program.

### D. Appeals

1. Students do not have the option to appeal a decision of guilt rendered by the hearing board, whether it is the first, second, or any subsequent offense. Students do not have the option to appeal the penalty determined by the faculty member for first offenses or to appeal the grade of *F* for the course given for second offenses.

2. For offenses resulting in suspension or permanent dismissal, students have the option to present written information to the President of the University to appeal the length of the suspension or to appeal a decision of dismissal. Students must present information in their defense, as allowed in this paragraph, to the President within five working days after receipt of written notification of the suspension or dismissal; however, as stated in number 1 above, students cannot appeal a decision of guilt rendered by the hearing board.

## ACADEMIC MISCONDUCT

A university is a community of scholars dedicated to the free inquiry of knowledge and truth. It follows as a basic tenet that scholars will conduct themselves with integrity in academic pursuits. In instances where academic standards may have been compromised, Clemson University has a responsibility to protect this process and to respond appropriately and expeditiously to charges of academic misconduct. Academic misconduct includes, but is not limited to, submission of fraudulent admission credentials, academic dishonesty, falsification of data in research and plagiarism in theses, dissertations, or other final projects.

### I. General

A. Academic dishonesty includes giving, receiving or using unauthorized aid on any academic work.

B. Plagiarism, a form of academic dishonesty, includes the copying of language, structure or ideas of another and attributing the work to one's own efforts.

C. All academic work submitted for grading contains an implicit pledge and may contain, at the request of the instructor, an explicit pledge by the student that no unauthorized aid has been received.

D. Academic dishonesty includes attempts to copy, edit, or delete computer files that belong to another person or use Computer Center account numbers that belong to another person without the permission of the file owner, account number owner, or file number owner.

### II. Penalties

A. A student guilty of the first offense of academic dishonesty typically will receive a grade of *F* for the course. In flagrant cases, the student may also be suspended for one or more semesters or may be permanently dismissed.

B. A student guilty of the second offense of academic dishonesty will receive a grade of *F* for the course, will be suspended for one or more semesters, and may be permanently dismissed. Suspension and dismissal require approval of the President of the University.

### III. Procedures

Academic honesty is the individual responsibility of each student. Students should report violations of this policy either to the instructor of the affected course or to any member of the administration. When, in the opinion of an instructor, a student has committed an act of academic dishonesty, the following procedure must be followed:

1. The instructor will inform the student in private of the nature of the alleged charge of academic dishonesty and will simultaneously request in writing that the department chair verify from the registrar if the incident is a first offense.

2. When this information has been received, the instructor will notify the student in writing of the charge of academic dishonesty and the penalty recommended by the instructor and approved by the chair of the department in which the course is taught. The notification will further state that if

the student regards the charge as unfair, the student has seven days from the date of receipt of notice to file a grievance with the Graduate Student Grievance Committee.

3. If no grievance is filed by the student, the instructor will forward copies of the written notification to the dean of the college and to the registrar.

4. Should the act of dishonesty not be in the college of the student's major, the registrar will notify the major department chair.

5. A charge of academic dishonesty in a course must be made within 45 calendar days of the date printed on the grade report for the semester or session in which the course is completed. For grades that replace an original grade of *I* (incomplete), the 45 days begin the day the *I* is converted to the final grade.



## POLICIES

### ACADEMIC INTEGRITY

See page 28.

### ACADEMIC MISCONDUCT

See page 29.

### ACADEMIC MISCONDUCT FOR FORMER STUDENTS

It is possible that an act of academic misconduct will remain undiscovered until after a degree is awarded. In such a case, Clemson University reserves the right to revoke any degree based on new revelations about scholarly issues including, but not restricted to, admission credentials, all forms of coursework, research, theses, dissertations, or other final projects.

#### I. Submission of Fraudulent Admissions Credentials

Submission of fraudulent admissions credentials in the student's application or any other documents submitted for admission to Clemson University may result in initiation of action under the Policy and Procedure on Revocation of Academic Degrees.

#### II. Academic Dishonesty in Coursework

A. In the event that the act is alleged to have occurred within the context of a course and is consistent with the general definition of academic dishonesty presented in Sections I of the Policy on Academic Misconduct for Enrolled Students, the same procedures in that policy will apply except for academic misconduct listed in III below.

B. Graduate Students—If the resulting penalty is either the assignment of a grade of *D* or *F* in a required graduate course, or the issuance of any grade that causes the student not to possess a cumulative *B* average in both graduate courses and in all courses, action under the Policy and Procedures on Revocation of Academic Degrees may be initiated.

C. Undergraduate Students—If the resulting penalty causes the student no longer to have the necessary credit hours, coursework, or grade average for receiving a degree, action under the Policy and Procedures on Revocation of Academic Degrees may be initiated.

#### III. Falsification of Data and Plagiarism in Theses, Dissertations, or Other Final Projects

Data falsification, plagiarism (as defined in the Academic Misconduct Policy) and other acts of academic dishonesty in a thesis, dissertation, or other final project are serious acts of misconduct. Allegations of this type of misconduct may result in initiation of action under the Policy and Procedure on Revocation of Academic Degrees.

## ACADEMIC RESEARCH

### Policy on Research Ethics

#### I. Preamble

Research institutions have a critical responsibility to provide an environment that promotes integrity, while at the same time encouraging openness and creativity among scholars. Care must be taken to ensure that honest error and ambiguities of interpretation of scholarly activities are distinguishable from outright misconduct. To address all allegations of fraud or misconduct, definitions, policies, and procedures must be in place to facilitate and guide such processes.

This policy is applicable to all researchers associated with Clemson University, including faculty, students, and staff. If charges are brought against nonfaculty members of Clemson University, appropriate substitutions should be made for the role of the Faculty Senate officers and dean. If charges are brought against a former student that could result in the student's degree being revoked, those charges should be processed through the University's Policy and Procedure on Revocation of Academic Degrees rather than through this policy.

#### II. Definitions

A. Research: Research is used in a general sense (as opposed to scientific research) to yield a policy applicable to all academic disciplines in the University.

B. Misconduct: Dishonest deviation from accepted practices in conducting research activities; fraudulent failure to comply with university, regulatory, and funding agencies requirements affecting specific aspects of the conduct of research. This definition includes

Falsification of data—ranging from falsification or intentional misrepresentation of methods, materials, or results to selective reporting of findings, such as the purposeful omission of conflicting data with the intent to manipulate the results;

Plagiarism—representation of borrowed work as one's own;

Misappropriation of others' ideas—the unauthorized and intentionally dishonest use of privileged information (such as that which might be gained during peer, paper, or grant reviews), however obtained; malicious and public misrepresentation of a colleague's ethical research behavior; conflicts of interest that could influence the researcher's decisions or conclusions or which could provide unfair gain to the researcher; other misuse of position as researcher for personal gain; exploitation (such as failure to credit work, misrepresentation of a research relationship, etc.) of students, or other persons, for research purposes.

This definition does not include non-fraudulent failure or inadequacy of performance, incompetence, or honest error; non-fraudulent breaches of contracts; employment discrimination, sexual harassment, violation of human subjects policy or animal welfare policy; or other forms of misconduct that are the concerns of different, distinctive administrative policies.

C. Inquiry: Expeditious gathering and review of information to determine if an investigation is warranted. This is not a formal hearing, but a process designed to separate frivolous, unjustified, or mistaken allegation from facts regarding the incident.

D. Investigation: A formal examination and evaluation of all relevant facts to determine if an instance of misconduct has occurred.

E. Disposition: The Committee of Investigation shall determine only whether a breach of ethics has occurred and will not make recommendations relative to the nature or severity of the action to be taken.

If the investigation committee finds that the complaint was intentionally dishonest and malicious, the committee can recommend action against the accuser.

In the event that allegations are not confirmed, the institution shall make full efforts to restore the reputation of the accused; the accused's recommendations to accomplish this should be accommodated insofar as is possible.

#### III. Procedures

A. Overall Structure: An allegation or complaint involving the possibility of misconduct can be raised by anyone. The allegation should be made in writing to the Faculty Senate president in a confidential manner. Accusations must be signed.

Charges must be filed within seven years of the date on which the event in question occurred. If the date of limitation is in question, the Faculty Senate president, the chair of the Faculty Senate Research Committee, and the vice president for research shall determine whether the given event occurred within the specified time limit.

The Faculty Senate president and the chair of the Faculty Senate Research Committee should accept the accusation only after they are satisfied that its substance complies with this policy's definition of "misconduct." At this time, and at their discretion, they may consult with the vice president for research relative to the alleged research ethics violation.

A meeting should be scheduled to occur within 20 calendar days following acceptance of the accusation for the accused to appear before the president of the Faculty Senate and the chair of the Faculty Senate Research Committee for the purpose of hearing the charge(s) and being informed of who authored the charges. The accused will be asked to plead "guilty" or "not guilty" to each charge. If the accused pleads "guilty," the president of the Faculty Senate will report the facts to the vice president for research, who will, within 90 calendar days, prepare a report for the provost.

If the accused pleads "not guilty," or if the accused refuses to respond, an inquiry, the first step of the review process, should result. The vice president for research should be notified of the inquiry. In the inquiry state, factual information is gathered and expeditiously reviewed to determine if an investigation of the charge is warranted. An inquiry is not a formal hearing; it is designed to separate allegations deserving of further investigation from frivolous, unjustified, or clearly mistaken allegations. The vice president for research will inform the accuser of the disposition at the conclusion of the investigation stage.



During the initial meeting with the accused for the purpose of presenting charges, only the Faculty Senate president, the chair of the Faculty Senate Research Committee, and the accused with his/her lawyer, if desired, may be present. During hearings by the Committee of Inquiry or the Committee of Investigation, only duly appointed members of the given committee and the committee's invited witnesses with his/her lawyer, if desired, may be present.

**B. Inquiry:** The vice president for research and the Faculty Senate president will appoint, within ten calendar days of a response of "not guilty" to charges by the accused, a Committee of Inquiry of three faculty members with one individual appointed as chair.

For any specific allegation or set of allegations, the Committee of Inquiry will determine if an investigation is warranted. The Committee of Inquiry will submit a written report to the vice president for research and the Faculty Senate president within 30 calendar days of the formation of the Committee of Inquiry.

**C. Investigation:** If the Committee of Inquiry so recommends, the vice president for research and the Faculty Senate president will appoint within 20 calendar days a Committee of Investigation consisting of five faculty members, other than those serving on the Committee of Inquiry, to conduct a full investigation.

The Committee of Investigation, meeting in closed sessions, will review all materials, question relevant parties, and allow for all parties to present their views separately (without the presence of the other parties) to the committee.

The Committee of Investigation will prepare, within 90 calendar days, a report indicating whether ethics violations have occurred; the report may include estimation of one or more of the following:

- the scope of the intentional dishonesty perpetrated by the accused;
- the degree of gain that might accrue to the accused because of the unethical behavior;
- the seriousness of harm intentionally perpetrated against other individuals.

The estimation shall be used in determining disciplinary action against the accused. In less serious cases, action may include a verbal reprimand, or, if conditions warrant, a letter in the offender's personal file. In more serious cases, action might include such sanctions as additional supervision of research activity, loss of merit pay, or recommendation against promotion. In only the most serious cases should dismissal be considered.

The report will be submitted to the vice president for research and the Faculty Senate president, who will forward the report to the provost.

The provost will review the report and render a decision within 15 calendar days. Any recommendation that may constitute disciplinary action against a faculty member will be referred by the provost to the appropriate dean or other administrator as determined by the provost. The dean or administrator will decide the appropriate action within 15 calendar days.

If disciplinary action taken against a faculty member constitutes a grievable action under either Faculty Grievance Procedure I or Faculty Grievance

Procedure II, the faculty member may file a grievance in accordance with the appropriate procedure. Disciplinary action against other individuals associated with the University are subject to applicable grievance procedures.

**D. Guiding Principles:** Maximize confidentiality and protect the reputations for both the accused and accuser during the full process.

Assure the respondent a fair hearing and access to reports.

Minimize the number of individuals involved in the inquiry and investigation phases.

Individuals chosen to assist in the inquiry process should have no real or apparent conflicts of interest bearing on the case in question. They should be unbiased and have appropriate background for judging the issues being raised.

Consultation of University legal counsel is probably necessary.

Appropriate funding agencies should be fully informed in writing at both the outset and conclusion of an investigation.

All detailed documentation of the committees of Inquiry and Investigation shall be maintained by the Office of the Vice President for Research for at least three (3) years and must, upon request, be provided to authorized personnel.

Appropriate interim administrative actions will be taken by the vice president for research at the outset of the inquiry stage to protect supporting funds and to ensure that the purposes of the project are being met.

## Executive Interpretation

### Definitions

**II.B.** The Research Ethics Policy clearly restricts action to matters of research ethics; it does not address such things as simple ineptitude, nonfraudulent breach of contract or malpractice covered by existing policy. (See exclusions under section II.)

Note the following:

The definition includes malicious and public (suggesting that neither maliciousness nor publicness, alone, is sufficient) misuse of the research ethics policy itself (reference section II.E.).

Exploitation of others includes misuse of colleagues, such as intentional and malicious failure to credit the work of another, deliberately misleading other individuals to obtain research goals, etc. It does not include benign activity that seems to, or may actually, exploit.

This policy should not be construed to include any activity that is benign in intent (not malicious, deliberately misleading, etc.).

**II.E.** It is the responsibility of University faculty to protect its research integrity by condemning unethical research activity, by investigating credible charges of unethical research brought against the faculty's peers, by taking steps to restore the reputations of peers that are charged unjustly or in error, by assessing the damage done by an unethical peer if appropriate (See section III.C.), and by seeking sanction through University administrative authorities against those who violate ethical re-

search practices. Appropriate administrative personnel alone have the authority to deprive one of property or liberty interests (within legal constraints). Consequently we feel that the assessment and pursuit of sanctions against an individual should not be a matter addressed by this policy.

**III.A.** Charges which do not fall within the purview of this policy (See section II.B.) should not be forwarded to a Committee of Inquiry. The processes of Inquiry and Investigation threaten an academician's most cherished professional possession—his/her reputation. That reputation should not be threatened without clear cause, thus charges that do not involve "Research Ethics" as defined by this document should be pursued through other channels. For these reasons, the president of the Faculty Senate and the chair of the Faculty Senate Research Committee, upon receipt of the charges, should confirm that the charges comply in substance with this policy's definitions before any action is initiated. This is not to say that the president of the Faculty Senate and the chair of the Faculty Senate Research Committee should judge the legitimacy of the charges or the facts of the case.

Because the vice president for research has an overall view of University policy and activities that may be valuable at this stage of the process, the president of the Faculty Senate and the chair of the Faculty Senate Research Committee, at their discretion, may consult with the vice president for research prior to rendering a decision about whether the charges should go forward under this policy.

It is in the interest of the accused and the University to provide an opportunity to the accused to abbreviate the procedures outlined in this policy. Specifically, the accused need not be subjected to the trauma of a peer investigation if indeed he/she would prefer to admit guilt and be subjected to appropriate administrative sanction.

**III.B.** A Committee of Inquiry is responsible for determining whether the facts in the case are contentious (sufficient uncertainty exists to prevent a determination of innocence without extensive investigation) or that there is a probability that the accused's position is or is not credible.

A driving concern of the Committee of Inquiry is the protection of all involved and particularly that of the accused. Toward this end, a Committee of Inquiry should balance the need for information upon which to make a decision against the need for confidentiality, with the balance in favor of confidentiality. The merit of charges cannot always be made on the strength of charges alone; thus, to adequately protect the accused against a potentially damaging investigation, the committee may need to expand its inquiry beyond the charges and accompanying documentation. At the same time, it must be realized that the likelihood of trauma and damage to reputation increases as the scope of an inquiry grows. The pertinent question is, how far should a Committee of Inquiry go to protect an unjustly charged individual against a more extensive investigation given the need to limit the scope of knowledge about the charges? The answer is that the Committee of Inquiry should limit its efforts to the minimum needed to establish that the facts in the case are contentious or that there is a probability that the



accused's position is or is not credible. Certainly the accused should have the opportunity to respond to the charges before the Committee of Inquiry.

The Committee of Inquiry may need to seek clarification from the accuser and may even need to resolve doubts by seeking evidence from another source. At all times, however, the Committee of Inquiry should seek to confine the extent of knowledge about the charges leveled and, consequently, should cease its inquiry as soon as it can conclude that the charges may or may not be grounded (not that the charges are or are not true). Strategies may include strictly limiting the number of individuals approached about the matter, limiting witnesses to individuals who have prior knowledge of the charges or soliciting documentation from involved parties.

In addition to determining probability of ethics violation, the Committee of Inquiry should clarify the charges brought against the accused. This involves throwing out charges that are frivolous or ungrounded and identifying those charges that may be grounded.

A subsequent Committee of Investigation, because its investigation is more thorough, need not, of necessity, be bound to the scope defined by the Committee of Inquiry but should give credence to its recommendations.

III.C. The Committee of Investigation is responsible for determining whether an ethics violation has occurred relative to the situation addressed by the charges. Such violation need not be limited to the specific charges, but should be related to the incidents addressed by those charges. The person who brings charges may be aware of only some of the ethical violations associated with a given incident; thus, an investigation needs the freedom to note problems relative to that incident which it may uncover during the course of investigating the charges.

The Committee of Investigation, like its predecessor, is concerned with protecting the integrity of the parties involved. Consequently, it too should balance the need for information upon which to make a decision against the need for confidentiality. In this case, however, the balance should favor the gathering of information. It is more important that this committee be correct in its decision than it is to limit the scope of knowledge about the investigation. The committee should, of course, cease operation when it has enough information to make a just decision, but should not jeopardize justice in the name of confidentiality.

## ENGLISH FLUENCY

Clemson University has established a policy to assure that all instructional activities are conducted by individuals possessing appropriate proficiency in written and oral use of the English language. Instructional activities include lectures, recitation or discussion sessions, and laboratories. The individuals to be certified include full-time and part-time faculty, graduate teachers of record, graduate teaching assistants, and graduate laboratory assistants for whom English is not the first language.

A student who experiences difficulty with an instructor's written or oral English and who wishes to seek relief must do so prior to the seventh meeting of a 50-minute class and prior to the fifth meeting of a 90-minute class in regular semesters. In the five-week summer sessions, relief must be sought prior to the third class meeting.

The procedure is summarized as follows:

- a. The student must quickly bring the problem to the attention of the instructor's department chair either directly or through a faculty member such as the student's advisor. That department chair will assess the complaint and, if deemed valid, offer an appropriate remedy within two days.
- b. A student who is not satisfied with the department chair's decision or the relief suggested, may appeal within two days to a five-member hearing panel comprised of three faculty members and two students appointed by the Senior Vice Provost and Dean of Undergraduate Studies.

Students with questions should contact the Associate Dean of Undergraduate Academic Services, E-108 Martin Hall.

## EQUAL OPPORTUNITY/AFFIRMATIVE ACTION

Clemson University, in compliance with Titles VI and VII of the Civil Rights Act of 1964, as amended, Title IX of the Education Amendments of 1972, and Sections 503 and 504 of the Rehabilitation Act of 1973, does not discriminate on the basis of race, color, national origin, religion, sex, or disability in any of its policies, procedures, or practices; nor does the University, in compliance with the Age Discrimination in Employment Act of 1967, as amended, and Section 402 of the Vietnam Era Veterans Readjustment Act of 1974, discriminate against any employees or applicants for employment on the basis of their age or because they are disabled veterans or veterans of the Vietnam era. Clemson University conducts its programs and activities involving admission, access, treatment, employment, teaching, research, and public service in a nondiscriminatory manner as prescribed by Federal laws and regulations.

In conformance with University policy and pursuant to Executive Order 11246, as amended, Section 503 of the Rehabilitation Act of 1973, and Section 402 of the Vietnam Era Veterans Readjustment Act of 1974, Clemson University is an Affirmative Action/Equal Opportunity Employer.

Inquiries concerning the above may be addressed to the following:

Executive Secretary, Clemson University Board of Trustees, 201 Sikes Hall, Clemson University, Clemson SC 29634

Director, Office for Access and Equity, E-103 Martin Hall, Clemson University, Clemson SC 29634

Director, Office for Civil Rights, Department of Education, Washington DC 20201.

## FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT

The Family Educational Rights and Privacy Act of 1974 (FERPA) affords eligible students certain rights with respect to their education records. They are as follows:

1. The right to inspect and review the student's education records (provided the student has not waived this right) within 45 days of the day the University receives a request for access.

Students should submit to the registrar, dean, head of the academic department, or other appropriate official, a written request identifying the record(s) they wish to inspect.

The University official will make arrangements for access and notify the student of the time and place where the records may be inspected. If the records are not maintained by the University official to whom the request was submitted, that official shall advise the student of the correct official to whom the request should be addressed.

2. The right to request the amendment of the student's education records that the student believes are inaccurate or misleading.

Students may ask the University to amend a record that they believe is inaccurate or misleading. To challenge the accuracy of an education record, the student should write to the registrar or other University official responsible for the record and clearly identify the part of the record he/she wants changed and specify why it is inaccurate or misleading. If the University official decides not to amend the record as requested by the student, the University official will notify his/her vice president. The vice president will then notify the student of his/her right to a hearing regarding the request for an amendment. Additional information regarding the hearing procedures will be provided to the student when notified of his/her right to a hearing.

*Note:* The challenge of a student under this paragraph is limited to information which relates directly to the student and which the student asserts is inaccurate or misleading. With regard to a student's grade, this right does not permit the student to contest a grade on the grounds that a higher grade is deserved, but only to show that the grade has been inaccurately recorded.

3. The right to consent to the disclosure of personally-identifiable information contained in the student's education records, except to the extent that FERPA authorizes disclosure without consent.

One exception which permits disclosure without consent is disclosure to school officials with legitimate educational interest. A school official is a person employed by the University; a person or company with whom the University has contracted (such as an attorney, auditor, or collection agent); a person serving on the board of trustees; or a student serving on an official committee, such as a disciplinary or grievance committee, or assisting another University official in performing his/her tasks. A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his/her professional responsibilities.



Upon request, the University discloses education records without consent to officials of another school in which a student seeks or intends to enroll.

4. The right to refuse to permit the designation of any or all of the following categories of personally-identifiable information as directory information, which is not subject to the above restrictions on disclosure: student's full name, home address and telephone number, campus address and telephone number, campus e-mail address, state of residence, date and place of birth, marital status, academic class, class schedule and class roster, name of advisor, major field of study, including the college, division, department or program in which the student is enrolled, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance and graduation, degrees and honors and awards received including selection to a dean's list or honorary organization and the grade-point average of students selected, and the most previous educational institution attended. Photographic, video, or electronic images of students taken and maintained by the University are also considered directory information.

Directory information may be disclosed by the University for any purpose, at its discretion. Any student wishing to exercise his/her right to refuse to permit the designation of any or all of the above categories as directory information must give written notification to the Registration Services Office (E-206 Martin Hall) by the last day to register for the enrollment period concerned as published in the Clemson University calendar.

5. The right to file a complaint with the U.S. Department of Education concerning alleged failures by Clemson University to comply with the requirements of FERPA. The name and address of the office that administers FERPA is Family Policy Compliance Office, U.S. Department of Education, 600 Independence Ave. SW, Washington DC 20202-4605.

## FAMILY PERSONAL PRIVACY ACT

The South Carolina Family Personal Privacy Act (SC Code 30-2-10 et. seq.) defines personal information as "...information that identifies or describes an individual including, but not limited to, an individual's photograph or digitized image, social security number, date of birth, driver's identification number, name, home address, home telephone number, medical or disability information, education level, financial status, bank account(s) number(s), account or identification number issued by and/or used by any federal or state governmental agency or private financial institution, employment history, height, weight, race, other physical details, signature, biometric identifiers, and any credit records or reports."

Some of the information in documents which students provide to Clemson University may be personal information as defined above. Pursuant to Section 30-2-40 B, students are advised that this information may be subject to public scrutiny or release. They are also advised that personally-identifiable information contained in these educational

records falls under the federal Family Educational Rights and Privacy Act of 1974, as amended (FERPA). If students elect to opt out of the release of directory information under FERPA, the University will not release any personal information except as otherwise required or authorized by law.

## GRIEVANCES

### Office of the Ombudsman

The ombudsman is an independent, confidential resource who provides assistance to faculty, graduate students, and postdoctoral students in resolving problems, complaints, and conflicts when normal procedures have not worked satisfactorily. The Ombudsman's Office serves as a central information source on policies, procedures, and regulations affecting faculty, graduate students, and postdoctoral students. The office refers individuals to persons able to resolve problems or handle appeals at the lowest possible level. Where appropriate, the ombudsman can facilitate communication or mediate between parties.

The ombudsman strives to ensure that faculty, graduate students, and postdoctoral students receive fair and equitable treatment within the University system. He/she provides an independent point of view in an informal and confidential environment. The ombudsman will not identify the student or discuss the student's personal concerns with anyone without the student's permission. Private confidential meetings can be arranged at the student's convenience. All communications will be treated with strict confidentiality.

The ombudsman works toward resolutions based on principles of fairness. He is neither an advocate for faculty, administration, or students, nor an agent of the University.

The Office of the Ombudsman is available to assist faculty members, graduate students, and postdoctoral students who

- need guidance in resolving a problem or concern relating to the University
- need information about policies or procedures;
- need someone to mediate between individuals or within the University
- feel the University has made an error in a particular case
- feel they have been victims of harassment or discrimination
- are unsure about which University policies, procedure, or regulations apply to a situation
- have specific academic problems that cannot be resolved by following regular University procedures
- feel they have been unfairly treated
- have a problem that requires someone to negotiate a solution or to help facilitate communication between parties
- feel that a University policy, procedure, or regulation has been applied unfairly or erroneously

Additional information is available on the Web at [virtual.clemson.edu/groups/FacOmbudsman/](http://virtual.clemson.edu/groups/FacOmbudsman/).

## Academic Grievance Committee

The Graduate Student Academic Grievance Committee hears all grievances involving the following:

- grievances of a personal or professional nature involving an individual student and a faculty member
- a claim by a student that the final grade in a course was inequitably awarded
- cases involving graduate student employment
- graduate student academic dishonesty. In all unresolved cases, the committee makes its recommendations to the president through the provost

All proceedings of the committee are confidential.

Membership of this committee consists of the following: five faculty members involved in graduate education (one from each college) elected by the collegiate faculty for three-year terms, two graduate students nominated annually by the Clemson Graduate Student Government (CGSG) and appointed by the provost, and one representative of the Graduate School serving in a nonvoting, advisory role. Each year the chair is elected from among the continuing faculty members. The terms of appointment begin with each fall registration.

## Rules and Procedures

Current procedures are available from the Graduate School.

## HARASSMENT

In general, harassment is unwelcome verbal or physical contact, based upon race, color, religion, sex, gender, national origin, age, disability, status as a military veteran, or protected activity (i.e., opposition to prohibited discrimination or participation in the statutory complaint process), that unreasonably interferes with the person's work or educational performance or creates an intimidating or hostile work or educational environment. Examples may include, but are not limited to, epithets, slurs, jokes, or other verbal, graphic, or physical contact.

### Sexual Harassment

Title VII of the Civil Rights Act of 1964, as amended, prohibits employment discrimination on the basis of race, color, national origin, religion, or sex. Sex discrimination has been interpreted by the U.S. Supreme Court to include sexual harassment. The Equal Employment Opportunity Commission (EEOC) defines sexual harassment as sexual advances, requests for sexual favors, and other verbal or physical contact of a sexual nature when

1. submission to such conduct implicitly or explicitly is made a term or condition of an individual's employment or academic performance; or
2. submission to or rejection of such conduct by an individual is used as the basis for decisions such as employment, promotion, reassignment, selection for training, performance evaluation, or the basis of academic evaluation or recommendations; or
3. such conduct has the purpose or effect of creating an intimidating, hostile, or offensive working or educational environment, or interfering substantially with an employee's work performance or a student's academic performance.



Clemson University's Sexual Harassment Policy prohibits sexual harassment in any form against faculty, staff, or students. Persons found to be in violation of the policy will be subject to immediate and appropriate disciplinary action up to and including termination of employment for faculty or staff and expulsion from the University for a student. These sanctions also apply if an employee or student is found to have intentionally brought false charges against another member of the Clemson community.

Employees or students who feel they are victims of sexual discrimination are encouraged to consult the Office of Access and Equity, E-103 Martin Hall, (864) 656-3181, for advice and assistance in resolving complaints.

Both informal and formal procedures for resolving complaints are included in the University's harassment policy. Should the results of the informal complaint process be unsatisfactory to the complainant, the appropriate grievance procedure can be initiated.

In the event a graduate student wishes to appeal the resolution of the Office of Access and Equity, the student must submit a written request for an appeal to the Dean of the Graduate School, who in turn will convene an ad hoc committee that will review the process and/or sanction. The committee membership will come from faculty and students already appointed to the Graduate Council.

### Racial Harassment

It is the policy of Clemson University to conduct and provide programs, activities, and services to students, faculty, and staff in an atmosphere free from racial harassment. Racial harassment is any behavior that would verbally or physically threaten, torment, badger, heckle, or persecute an individual because of his/her race.

Racial harassment of students, faculty, staff, or visitors is a violation of the University's Harassment Policy and will subject the offender to immediate and appropriate disciplinary action.

### Amorous Relationships

Amorous relationships that might be appropriate in other circumstances can be inappropriate when they occur between a faculty member, officer, or supervisor of the University and any student or subordinate employee with whom he/she has a professional responsibility.

Those in positions of authority inherently carry the element of power in their relationships with students or subordinates. It is imperative that those with authority neither abuse, nor appear to abuse, this power entrusted to them.

Officers, supervisors, and members of the teaching staff should be aware that any romantic involvement with a student or subordinate employee could make them liable for formal action if a complaint is initiated. Even when both parties have consented to such a relationship, it is the officer, supervisor, or faculty member who may be held accountable for unprofessional behavior. Difficulties can also arise from third parties who may feel that they have been disadvantaged by such relationships. Graduate assistants, resident assistants, tutors, and undergraduate teaching assistants, who are also professionally responsible for students, would be wise to

exercise special care in their relationships with students they instruct or evaluate.

Questions concerning the University's policies on Sexual or Racial Harassment or Amorous Relationships should be directed to the Office of Access and Equity, E-103 Martin Hall, (864) 656-3181. The complete Harassment Policy can be found on the Web at [virtual.clemson.edu/groups/access/](http://virtual.clemson.edu/groups/access/).

## INFORMATION RESOURCES FOR STUDENTS

Clemson University computing resources are the property of Clemson University, to be used for University-related business. Students have no expectation of privacy when utilizing University computing resources, even if the use is for personal purposes. The University reserves the right to inspect, without notice, the contents of computer files, regardless of medium, the contents of electronic mailboxes, and computer conferencing systems, systems output, such as printouts, and to monitor network communication when

1. it is considered reasonably necessary to maintain or protect the integrity, security, or functionality of University or other computer resources or to protect the University from liability;
2. there is reasonable cause to believe that the users have violated this policy or otherwise misused computing resources;
3. an account appears to be engaged in unusual or unusually excessive activity;
4. it is otherwise required or permitted by law.

Use of University computing resources, including network facilities, account numbers, data storage media, printers, plotters, microcomputer systems, and software for computing activities other than those authorized by the University is strictly prohibited. Unauthorized use of such resources is regarded as a criminal act in the nature of theft, and violators are subject to suspension, expulsion, and civil and criminal prosecution.

The following are examples of misuse of computing resources:

1. Unauthorized duplication, distribution, or alteration of any licensed software. This includes software licensed by the University and licensed software accessed using the computing networks.
2. Attempting to gain unauthorized access to any computing resource or data, at Clemson or anywhere on the Internet, or attempting to disrupt the normal operation of any computing resource or network.
3. Attempting to use another student's or employee's computer account or data, without their permission.
4. Using the University electronic mail system to attack other computer systems, falsify the identity of the source of electronic mail messages; sending harassing, obscene, or other threatening electronic mail; attempting to read, delete, copy, or modify the electronic mail of others without their authorization; sending, without official University authorization, "for-profit" messages, chain letters, or other unsolicited "junk" mail.

5. Knowingly infecting any computing resource with a software virus.

6. Tampering with the University computer network or building wiring or installing any type of electronic equipment or software that could be used to capture or change information intended for someone else.

7. Participating in a "denial of service" attack on any other computer, whether on or off campus.

8. Using University computing or network resources for personal gain or illegal activities such as theft, fraud, copyright infringement, sound or video recording piracy, or distribution of child pornography or obscenities.

Any suspected violations of this policy or any other misuse of computer resources by students should be referred to the Office of Student Judicial Services. That office will investigate the allegations and take appropriate disciplinary action. Violations of law related to misuse of computing resources may be referred to the appropriate law enforcement agency. Notwithstanding the above, the Division of Computing and Information Technology may temporarily suspend, block, or restrict access to an account, independent of University disciplinary procedures, when it appears reasonably necessary to do so in order to protect the integrity, security, or functionality of University or other computer resources, to protect the University from liability, or where the emotional or physical well-being of any person is immediately threatened. When DCIT unilaterally takes such action, it will immediately notify the account holder of its actions and the reason therefore in writing. The account holder may appeal the action taken by DCIT in writing to the vice provost of the Division of Computing and Information Technology.

Access will be restored to the account holder whenever the appropriate investigatory unit of the University determines that the protection of the integrity, security, or functionality of University or other computing resources has been restored and the safety and well being of all individuals can reasonably be assured, unless access is to remain suspended as a result of formal disciplinary action imposed through the Office of Student Judicial Services.

## PATENTS AND COPYRIGHTS

All students enrolling in Clemson University do so with full understanding that

1. The University has full ownership rights in any inventions, discoveries, developments, and/or improvements, whether or not patentable (inventions), which are conceived, developed, or reduced to practice or caused to be conceived, developed, or reduced to practice by graduate students during the course of their research activities conducted as part of any Graduate School curriculum. Any such invention will be handled by the University in the same manner as set forth in the *Faculty Manual of Clemson University*, the pertinent provision for which appears as Part IXB entitled "Patent Policy."
2. Copyright ownership of any research work will be determined by University policy and by policies of organizations responsible for publishing or distributing copyrighted material.



3. The initial right of students in copyright of ownership is subject to interests retained by Clemson University. The rights retained by Clemson University may be subject to interests of third parties.

Copies of the policies on patents and copyrights are available in the individual departments and colleges and in the Graduate School Office.

## REVOCATION OF ACADEMIC DEGREES

### Preamble

Academic institutions have a critical responsibility to provide an environment that promotes integrity, while at the same time encouraging openness and creativity among scholars. Care must be taken to ensure that honest error and ambiguities of interpretation of scholarly activities are distinguishable from outright misconduct. This policy is applicable to fraudulent or other misconduct in obtaining an academic degree which is so egregious that a mechanism for revoking an academic degree, either graduate or undergraduate, must be undertaken. The Clemson University Board of Trustees has the sole authority to revoke any degree previously awarded.

### Definitions

As used herein, the following terms shall apply:

A. When the degree holder was an undergraduate student:

1. "Dean" shall mean the dean of the academic college where student was enrolled.

2. "Committee of Investigation and Recommendation" shall be composed of the members of the standing University undergraduate Continuing Enrollment Appeals Committee. An undergraduate student will be appointed to the Committee of Investigation and Recommendation by the President of the Student Body within ten (10) calendar days of notification by the President of the Faculty Senate. Any member of the Continuing Enrollment Appeals Committee who is a faculty member in the department which awarded the degree involved shall not be a member of the Committee of Investigation and Recommendation for that particular investigation. If there are fewer than three (3) non-disqualified faculty members, the President of the Faculty Senate shall appoint additional faculty members to bring the number of faculty committee members up to three.

3. If the President of the Faculty Senate is from the same department that awarded the degree involved, the President-Elect of the Faculty Senate shall appoint the additional member.

B. When the degree holder was a graduate student:

1. "Dean" shall mean the Dean of the Graduate School.

2. "Committee of Investigation and Recommendation" shall be composed of the members of the standing University Graduate Admissions and Continuing Enrollment Appeals Committee, except for the Associate Dean of the Graduate School who shall not be a member of the Committee of Investigation and Recommendation. A graduate student will be appointed to the Committee of Investigation and Recommendation by the President of Graduate Student Government within ten (10) calendar days of notification by the President of the Faculty Senate. Any member of the Graduate Admissions and Continuing Enrollment Appeals

Committee who is a faculty member in the department which awarded the degree involved shall not be a member of the Committee of Investigation and Recommendation for that particular investigation. If there are fewer than three (3) non-disqualified faculty members, the President of the Faculty Senate shall appoint additional faculty members to bring the number of faculty committee members up to three (3). If the President of the Faculty Senate is from the same department that awarded the degree involved, the President-Elect of the Faculty Senate shall appoint the additional member.

### Complaint

An allegation or complaint involving the possibility of misconduct can be raised by anyone. The allegation should be made in writing to the dean.

### Initial Review

The Dean will conduct the initial review to determine whether or not the allegation has merit. The Dean may discuss the matter with the former student's advisory committee (if any) and other faculty as appropriate. The Dean may also contact persons outside the University who may be able to provide factual information on the alleged misconduct or who may otherwise have expertise concerning issues involved in the alleged misconduct. If the Dean determines that the allegation has no merit, he/she will terminate the investigation. If the Dean determines that serious academic misconduct is suspected, the Dean will notify the President of the Faculty Senate in writing in a confidential manner. The Dean shall also notify the Vice President for Academic Affairs and Provost of the charge but will not discuss any details of the charge.

### Committee of Inquiry

The President of the Faculty Senate shall, within ten calendar days of receipt of the notification from the dean, appoint three (3) faculty members to the Committee of Inquiry and notify the President of Graduate Student Government or the President of the Student Body, as appropriate, who shall appoint a graduate or undergraduate student, as appropriate, to the Committee of Inquiry within ten (10) calendar days of notification. The President of the Faculty Senate shall also notify the degree holder of the formation of a Committee of Inquiry.

If the Faculty Senate President is from the same department that awarded the degree involved, the President-Elect of the Faculty Senate shall appoint the Committee of Inquiry. The faculty members will be appointed from departments which did not award the degree involved. The Committee will elect its chairman from the faculty members on the Committee.

For each allegation, the Committee of Inquiry will review the complaint and any other information provided by the dean and determine whether there is sufficient evidence to warrant a formal charge of academic misconduct and further investigation under this policy. While the Committee of Inquiry shall not make a recommendation as to whether a degree should be revoked, the purpose is to provide a review to separate frivolous, unjustified, or mistaken allegations from those requiring a more detailed and formal investigation. The Committee of Inquiry will review the evidence and must determine that the alleged misconduct more probably than not occurred

in order for the committee to recommend a formal charge and further investigation.

Within thirty (30) calendar days of the formation of the Committee of Inquiry, the Committee of Inquiry will submit a written report to the President of the Faculty Senate. If the Committee of Inquiry's report finds that the investigation should not proceed, the President of the Faculty Senate shall terminate the investigation and notify the appropriate persons. If the Committee of Inquiry's report finds that a formal charge and further investigation are warranted, the President of the Faculty Senate shall, within ten (10) calendar days of receipt of the report of the Committee of Inquiry, send a copy of that report to the Dean and to the Committee of Investigation and Recommendation. The President of the Faculty Senate shall also immediately notify the President of Graduate Student Government or President of the Student Body (whichever is appropriate) that a student representative needs to be appointed to the Committee of Investigation and Recommendation. The President of the Faculty Senate shall also notify the Vice President for Academic Affairs and Provost of the Committee of Inquiry's recommendation. No details of the charge will be discussed. *Note:* A majority vote of the Committee of Inquiry is necessary to recommend that a formal charge and further investigation are warranted. A tie vote means that the investigation is terminated as stated herein.

### Notification to Degree Holder

The Dean shall issue in writing, within ten (10) calendar days of receipt of the report of the Committee of Inquiry, a formal charge of academic misconduct to the degree holder. This written notice shall detail the factual allegations for the charge and the evidence supporting the charge. This written notice shall also inform the degree holder that if the charges are substantiated, the degree holder's degree could be revoked. This written notice shall also inform the degree holder of his/her right to appear at a hearing as stated in this policy. The Dean shall also send with this notice a copy of this Policy and Procedure on Revocation of Academic Degrees to the degree holder. This notice shall be delivered to the accused in person or sent by certified mail, return receipt requested.

### Committee of Investigation and Recommendation

The Committee of Investigation and Recommendation shall extend to the degree holder due process which shall, at a minimum, include the following:

1. notice of the nature of the complaint;
2. notice of the evidence supporting the complaint;
3. notice of the hearing;
4. the opportunity to present evidence, including testimony;
5. the opportunity to hear the testimony against the degree holder;
6. the opportunity to ask questions of all witnesses;
7. The opportunity to have an attorney or advisor present at the hearing; however, the role of the attorney or advisor shall be solely to assist the party, and the attorney or advisor shall not be permitted to participate actively in the proceedings.



The degree holder shall not be entitled to know the identity of the person(s) who originally made the complaint unless that person agrees that his/her identity can be revealed.

The chair of the Committee of Investigation and Recommendation shall inform the degree holder of the time and date of the hearing.

The Dean or his/her designee shall present the accusation against the degree holder at the hearing and may have one additional representative present during the hearing. Under this section the term "Dean" is understood to include the Dean's designee, if such a designation is made.

The degree holder and the Dean may submit written materials to the Committee of Investigation and Recommendation prior to the hearing. The chair of the Committee of Investigation and Recommendation shall make available the materials received to the other party and to all committee members. The hearing before the Committee of Investigation and Recommendation shall be held no sooner than thirty (30) calendar days and no later than ninety (90) calendar days after receipt of the report of the Committee of Inquiry unless the degree holder and the Dean agree to a different date. All matters pertaining to the hearing shall be kept as confidential as possible and the hearing shall be closed to the public. A verbatim record of the hearing will be taken and a type-written copy thereof transcribed and made a part of the hearing record. The degree holder and the Dean shall be responsible for having any witnesses they wish to testify in attendance at the hearing. Witnesses will be present only while testifying.

The chair of the Committee of Investigation and Recommendation shall take whatever action is necessary during the hearing to ensure a fair, orderly, and expeditious hearing. No formal rules of evidence will be followed. If any objection is made to any evidence being offered, the decision of the majority of the committee shall govern. Irrelevant, immaterial, or unduly repetitious evidence shall be excluded.

The degree holder and the Dean shall be permitted to offer evidence and witnesses pertinent to the issues.

The Dean shall present the case against the accused first. The accused shall then present his/her response.

The chair will allow each party to ask questions of the other party and will allow each party to ask questions of the other party's witnesses at the appropriate time during the hearing as determined by the chair. Members of the committee may ask questions of any party or any witness at any time during the hearing.

Within fifteen (15) calendar days of the conclusion of the hearing, the Committee of Investigation and Recommendation shall submit a written report to the Vice President for Academic Affairs and Provost. The report shall contain findings and a recommendation as to whether the degree holder's degree should be revoked. The Committee of Investigation and Recommendation must find clear and convincing evidence that serious academic misconduct has been committed in order to recommend the revocation of the degree holder's degree. If the Committee of Investigation and Recommendation does not find clear and convincing

evidence of serious academic misconduct, the Committee of Investigation and Recommendation cannot recommend revocation of the degree holder's degree and the matter shall be closed. *Note:* A majority vote of the Committee of Investigation and Recommendation is necessary to recommend the revocation of a degree holder's degree. This means that a tie vote will result in the matter being closed.

At the same time that the report is sent to the Vice President for Academic Affairs and Provost, the chair of the Committee of Investigation and Recommendation shall send a copy of the report to the degree holder, the Dean, and other appropriate persons involved in the process.

If the Committee of Investigation and Recommendation recommends that the degree holder's degree be revoked, the chair shall also send a complete copy of the hearing record to the Vice President for Academic Affairs and Provost. The hearing record shall consist of the transcript of the hearing and all documents that were submitted to the committee. The chair of the Committee of Investigation and Recommendation shall label which documents were submitted by each party when forwarding this information to the Vice President for Academic Affairs and Provost.

If the Committee of Investigation and Recommendation recommends that the degree holder's degree be revoked, the chair shall also send a copy of the transcript of the hearing to the degree holder and the Dean at the same time that it is sent to the Vice President for Academic Affairs and Provost.

### **Vice President for Academic Affairs and Provost**

If the Committee of Investigation and Recommendation recommends that the degree be revoked, the Vice President for Academic Affairs and Provost shall review the hearing record and the report of the Committee of Investigation and Recommendation. If the Vice President for Academic Affairs and Provost decides that the degree holder's degree should not be revoked, he/she shall notify the degree holder, the Dean, the Committee of Investigation and Recommendation, and other appropriate persons involved in the process, in writing, within twenty-one (21) calendar days of receipt of the transcript of the hearing; and the matter shall be closed. If the Vice President for Academic Affairs and Provost decides to recommend that the degree holder's degree should be revoked, the Vice President for Academic Affairs and Provost shall send that recommendation in writing to the President of the University within twenty-one (21) calendar days of receipt of the transcript of the hearing. The Vice President for Academic Affairs and Provost shall send to the President, along with his/her recommendation, the Committee of Investigation and Recommendation's report and the hearing record. The Vice President for Academic Affairs and Provost shall send a copy of his/her recommendation to the degree holder, the Dean, the Committee of Investigation and Recommendation, and other appropriate persons involved in the process.

If the Vice President for Academic Affairs and Provost is disqualified from reviewing the case, the Senior Vice Provost and Dean of Undergraduate Studies shall be substituted for the Vice President for Academic Affairs and Provost.

### **President**

If the Vice President for Academic Affairs and Provost recommends to the President that the degree holder's degree should be revoked, the President shall transmit that recommendation along with the report of the Committee of Investigation and Recommendation and the hearing record to the Executive Secretary of the Board of Trustees within thirty (30) calendar days of receipt. If the President wishes to make a recommendation, he/she shall review the recommendation of the Vice President for Academic Affairs and Provost, the report of the Committee of Investigation and Recommendation, and the hearing record and forward his recommendation to the Executive Secretary of the Board of Trustees within thirty (30) calendar days of receiving the recommendation of the Vice President for Academic Affairs and Provost.

### **Board of Trustees**

The Executive Secretary of the Board of Trustees shall send to all trustees the hearing record, the recommendation of the Vice President for Academic Affairs and Provost, the report of the Committee of Investigation and Recommendation, and the recommendation of the President, if any. A majority vote by the Board of Trustees, at a duly constituted Board meeting, is required to revoke an academic degree. The decision of the Board of Trustees shall be final.

### **Guiding Principles**

All actions taken by committees shall be effective by a majority vote.

All investigations, hearings, and actions shall be kept as confidential as possible except for notice of any revocation approved by the Board of Trustees.

A decision not to proceed at any stage of the proceedings set forth in this policy does not necessarily mean that the original complaint was groundless.

For good cause shown, at the request of either party and the approval of the other, the Vice President for Academic Affairs and Provost shall extend any time limit set forth in this policy. Any such time extension shall be communicated in writing to all appropriate parties.

### **Administrative Action if Degree is Revoked**

If a degree is revoked by the Board of Trustees, the former student's transcript will be modified to reflect that the degree was revoked, and the former student will be informed of the revocation and requested to return the diploma. If the former student was enrolled in a program requiring a thesis or dissertation, all bound copies will be removed from the Clemson University Library. In addition, for doctoral students, University Microfilms, Inc. will be notified and requested to take appropriate action.

Students whose degrees have been revoked may be eligible to reapply for admission according to normal University procedures and policies in effect at the time of reapplication.



# GRADUATE SCHOOL

Graduate School information is available on the Web at [www.grad.clemson.edu](http://www.grad.clemson.edu).

Graduate students are subject to the usual procedures and regulations of the University, except where these apply to undergraduate students only. Immediately upon enrollment, students should become acquainted with the degree requirements and the regulations published in this catalog.

## THE GRADUATE SCHOOL

The purpose of the Graduate School is to promote superior research and scholarship and provide the highest levels of education and training for students who may pursue careers in academia, government, the nonprofit sector, business, and industry. The mandate of the Graduate School is to assist departments in recruiting and supporting outstanding students who will be capable of continual inquiry into fundamental questions in their fields and who can communicate clearly their findings through research, scholarship, teaching, and service.

The Graduate School coordinates University-wide efforts in graduate education and is responsible for policies and standards governing graduate education. Clemson University's Graduate School administers all graduate programs of the University. Clemson University offers one educational specialist, 70 master's, and 37 doctoral degrees. The Graduate School oversees University fellowships and assistantships for graduate students.

The goals of the Graduate School are

- to assist in recruitment and retention of a diverse group of scholars
- to maintain uniformly high standards across all programs and evaluate degree programs
- to serve as a mediator for the graduate community
- to establish and promote a scholarly environment at all levels of inquiry
- to facilitate graduate program development and assist and coordinate interdisciplinary programs
- to develop and increase sources of financial support for graduate students
- to advocate and promote the well-being of graduate education

## GRADUATE STUDY

Graduate study is much more than a continuation of undergraduate work. Its true spirit is one of inquiry and the desire to add to human knowledge. Graduate study, therefore, should be contemplated only by students who have already demonstrated in their undergraduate programs unusual intellectual attainments and the power of independent thought and investigation.

A great university is distinguished by the quality and dedication of its faculty, the excellence of its graduates, and the pursuit of new knowledge through research and scholarship. Graduate education is a core mission of a research university. The unique nature of graduate education is its contribution to new

knowledge through research and the integration of that knowledge through education and public service grounded in research. The presence of rigorous graduate programs enhances the quality of instruction available to all students. Graduate admissions policies and processes are reviewed annually by the Graduate Advisory Committee.

Today graduate education is more crucial than ever because the global economy is knowledge-based. To survive and thrive, society needs ever-increasing amounts of knowledge; and that means graduate education. The well-being of South Carolina's economy and of our society depends on producing a sufficient number of well-educated and well-trained graduate students in a variety of fields.

Courses are offered leading to the research degrees of Master of Arts, Master of Science, and Doctor of Philosophy. In addition, courses are offered leading to the professional degrees of Doctor of Education; Education Specialist; Master of Agricultural Education; Master of Architecture; Master of Arts in Teaching; Master of Business Administration; Master of Career and Technology Education; Master of City and Regional Planning; Master of Construction Science and Management; Master of Education; Master of Electronic Commerce; Master of Engineering; Master of Fine Arts; Master of Forest Resources; Master of Human Resource Development; Master of Landscape Architecture; Master of Parks, Recreation, and Tourism Management; Master of Professional Accountancy; Master of Public Administration; Master of Real Estate Development.

## ADMINISTRATIVE MISSION

It is the administrative mission of the Graduate School to serve the unique needs of the students, faculty, staff, and the general public. Through efficient systems, the Graduate School encourages success by providing accurate information in a friendly and supportive environment. The Graduate School upholds quality academic and professional standards and provides guidance to facilitate the accomplishment of Clemson University's broader mission of teaching, research, and public service.

## ACADEMIC MISSION

The academic mission of the Graduate School is to foster excellence in scholarship and research and to ensure the highest quality and diversity of graduate education in keeping with the land-grant mission of teaching, research, and public service.

## GRADUATE COUNCIL

University faculty provide direction for the Graduate School through the Graduate Council. The council provides oversight for policy and procedural implementation related to graduate education; receives, stimulates, and originates proposals for the development of graduate education; reviews, considers, and disseminates recommendations from its constituent committees; and approves and forwards recommendations to the Academic Council. The Graduate Council has five committees described below. Their purposes, roles, and compositions are prescribed by the *Faculty Manual*.

The Graduate Advisory Committee reviews policies on noncurricular student academic matters and on issues affecting the general welfare of graduate students. The Admissions and Continuing Enrollment Committee addresses concerns related to admission procedures and dismissals from graduate programs. The Fellowships and Awards Committee selects recipients for University-wide fellowships and graduate awards. The role of the Academic Grievance Committee is outlined in detail in the section entitled *Grievances*. The Graduate Curriculum Committee acts for the faculty in reviewing proposals for curricular changes and recommends such changes to the provost. This committee is comprised of the Dean of the Graduate School, as a nonvoting chair, and faculty elected from college curriculum committees. Graduate Curriculum Committee meetings are open to graduate students and faculty.

## GRADUATE STUDENT GOVERNMENT

The mission of the Clemson Graduate Student Government (CGSG) is to represent the interests of all graduate students at Clemson University in four vital focus areas:

- Involvement—to encourage graduate student participation in the University process
- Communication—to act as liaison between the University and graduate students with an emphasis on honest and open communication
- Collaboration—to promote the efforts of graduate students and the University into one united mission of making the Clemson experience one of quality education and reward
- Development—to provide participatory learning experiences that allow for the enhancement of graduate students' academic, civic, social, and professional development

The CGSG is composed of all graduate students at Clemson University. Its Senate consists of one representative from each academic department. The Executive Board is comprised of the president, vice president, secretary, treasurer, and chairs of the CGSG committees. In addition, there are board seats for the executive assistant, news editor, and assistant news editor.

The CGSG elects representatives to various University boards, commissions, committees, or councils that solicit graduate student opinions. CGSG also participates in the planning and implementation of Graduate Student Orientation and the Graduate Student Research Forum. Information is available on the Web at [people.clemson.edu/~gsg/](http://people.clemson.edu/~gsg/).

## SCIENTIFIC RESEARCH

Graduate students conducting scientific research in a student role at Clemson University do so with the full understanding of the following:

1. At the discretion of their thesis advisors or employment supervisors, as appropriate, students may be required, at the initiation of the research efforts, to maintain and preserve all primary data and materials associated with the research and deliver these materials to their supervisors in complete, cataloged, and identified form before the students will have been deemed to have completed the requirements for their programs of study; and



2. At the discretion of their thesis advisors or employment supervisors, as appropriate, students may be required to keep clear, concise, and complete research notebooks as accurate records of their research activities and deliver these to their supervisors before they will have been deemed to have completed the requirements for their program of study.

## RESEARCH OPPORTUNITIES

### Research Division

Founded as a land-grant college dedicated to expanding the frontiers of knowledge to solve the problems of mankind, Clemson University is ranked among the top 35 universities in the United States in terms of revenue from patents and licenses. Ongoing research initiatives throughout the University are critical to maintaining America's competitiveness in a global marketplace and keeping our industries on the leading edge of progress. The Research Division coordinates the following activities: sponsored research; educational services; public service proposals to outside agencies; patent disclosures, applications, and negotiations of licensing agreements; research compliance and facility security clearance.

Information and assistance are available on applications for research support from federal and state agencies, industrial organizations, foundations, and institutes, as well as fellowships of interest to the faculty.

The Vice President for Research oversees all aspects of campus research, providing advice on University research activities and administrative support for the internal funding of annual faculty research grants and awards.

### Center for Advanced Engineering Fibers and Films

The Center for Advanced Engineering Fibers and Films (CAEFF) is a National Science Foundation Engineering Research Center that comprises a partnership between Clemson University and the Massachusetts Institute of Technology. The Center provides an integrated research and education environment for the systems-oriented study of fibers and films. To understand structure/property relationships in polymeric fibers and films, industries need a complete science base, computational models that integrate molecular information with continuum or microscopic-level models, and advanced visualization tools, as well as a new generation of engineers and scientists with experimental, modeling, and visualization expertise. CAEFF promotes the transformation from trial-and-error development to computer-based design of fibers and films.

CAEFF's strategic plan ties research and fundamental science, enabling technology, and engineered systems to marketplace needs. The Center's integrated testbeds provide proving grounds for interdisciplinary research projects. To address issues targeted by the Center's strategic plan, CAEFF's interdisciplinary research teams combine expertise in numerical modeling, analytical characterization, fiber and film formation, polymer processing, visualization, software development, and usability testing.

An integral part of CAEFF's mission is the education of students and professionals in the practice of fiber/film science and engineering. The educational philosophy of the Center values interdisciplinary, systems-related, holistic learning. Key features of the education program include curriculum development, communication skills, industry involvement, recruitment of underrepresented minorities and women, and outreach to pre- and post-college student populations.

A trusted partnership with industry allows the center to achieve its vision. CAEFF depends on active company support for its research and education programs and rapid transfer of technology to industry. Company representatives sit on the Industrial Advisory Board, which establishes research priorities and evaluates the center's progress toward its goal. Through their influence on center research programs, companies can directly impact the next generation of fiber and film industry personnel.

### Center for Optical Materials Science and Engineering Technologies

The Center for Optical Materials Science and Engineering Technologies (COMSET) is an internationally recognized centerpiece program at Clemson University focused on cutting edge research, education, and technology transfer on materials for optical fiber and related photonic technologies. COMSET investigators are a multidisciplinary team of faculty. Research thrusts include the synthesis, characterization, and integration of optic ceramics, and nanomaterials into application-specific structures for telecommunications, imaging, sensing, displays, and numerous other commercially critical technologies. Since its founding in 2000, COMSET has received over \$13 million in research funding from federal, state, and industrially sponsored programs, including ones from the National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA), the U.S. Army Research Office (ARO), the U.S. Air Force Office of Scientific Research (AFOSR), the U.S. Office of Naval Research (ONR), the National Aeronautics and Space Administration (NASA), the South Carolina Commission of Higher Education, Yazaki Corporation, 3M Corporation, and Dow Chemical, to name a few.

### Clemson University Experiment Station

The Clemson University Experiment Station is part of a nationwide system of scientists working to improve the quality of life for people in their home state, the nation, and the world.

Both undergraduate and graduate students work with researchers to develop science-based information needed to address issues such as agricultural productivity and profitability, economic and community development, environmental conservation, food safety and nutrition, and youth development.

Clemson scientists have been involved in agriculture and forestry research since 1889 when the University was founded. Today research is conducted in state-of-the-art laboratories, as well as on farms and forests on the Clemson campus and at five research and education centers strategically located in the

state's distinct soil and climate regions. Clemson researchers collaborate with colleagues on studies that span the globe, including the genetic structure and functions for plants and animals, the impact of urban sprawl on the environment, techniques to reduce bullying in schools, the active ingredients in medicinal plants, and the use of nanotechnology in food packaging to detect contamination.

The work of Experiment Station researchers has produced more than 100 new varieties of food and fiber crops and more than 40 patents. Each year, work is conducted on more than 100 projects funded through federal, state, and private sources, including the U.S. Department of Agriculture, the U.S. Forest Service, the National Science Foundation, the South Carolina General Assembly, and corporate partners.

### Clemson University Genomics Institute

The Clemson University Genomics Institute (CUGI) is a state-of-the-art research and training facility focusing on the discovery and functional analysis of important genes from plants, plant pests, animals, and microbes using the specialized tools of genomics. The application of genomics to agriculture, human health, and the environment will ensure continued improvement in crop productivity and environmental systems to feed and nurture an ever-growing world population.

The mission of CUGI is

- to serve as a BAC and EST library development for the genomes of agriculturally and environmentally important plants, animals, and microbes
- to serve as a repository and distribution center for BAC and EST library resources (clones, filters, and whole libraries) to the genomics community with an emphasis on agriculture and the environment
- to provide high-throughput DNA sequencing and physical mapping for identifying and characterizing important genes and genomic regions
- to develop and apply new approaches and research tools for genomics research
- to provide training for undergraduate, graduate, postdoctoral, and visiting scientists in genomics

### Godley-Snell Research Center

The Godley-Snell Research Center (GSRC) opened in 1995 as a full-service, state-of-the-art animal research facility. GSRC provides specialized facilities and resources to support biomedical and agricultural animal research and teaching programs at the University. GSRC is managed by the Office of Research Services under the direction of the University Veterinarian. Research Services is dedicated to providing the staff, facilities, and technology to support high quality animal research programs. Research Services staff includes veterinarians and professional and technical staff with training and experience in animal research.

GSRC provides laboratory animal housing for large and small research animals. GSRC maintains fully equipped support facilities including surgical operating rooms, procedural areas, radiology, ABSL3 biocontainment suites, necropsy, and laboratory bench space.



All Clemson University animal research facilities and programs have received full accreditation from the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC), and all animal programs meet or exceed the standards required by the federal Animal Welfare Act regulations and the Public Health Service Policy for the Humane Care and Use of Laboratory Animals.

### Oak Ridge Associated Universities

Since 1952, students and faculty of Clemson University have benefited from its membership in Oak Ridge Associated Universities (ORAU). ORAU is a consortium of 91 colleges and universities and a contractor for the U.S. Department of Energy (DOE) located in Oak Ridge, Tennessee. ORAU works with its member institutions to help their students and faculty gain access to federal research facilities throughout the country; to keep its members informed about opportunities for fellowship, scholarship, and research appointments; and to organize research alliances among its members.

Through the Oak Ridge Institute for Science and Education (ORISE), the DOE facility that ORAU operates, undergraduate, graduate, and postgraduate students, as well as faculty, enjoy access to a multitude of opportunities for study and research. Students can participate in programs covering a wide variety of disciplines including business, earth sciences, epidemiology, engineering, physics, geological sciences, pharmacology, ocean sciences, biomedical sciences, nuclear chemistry, and mathematics. Appointment and program length range from one month to four years. Many of these programs are especially designed to increase the numbers of underrepresented minority students pursuing degrees in science- and engineering-related disciplines. A comprehensive listing of these programs and other opportunities, their disciplines, and details on locations and benefits can be found on the Web at [www.ornl.gov/orise/educ.htm](http://www.ornl.gov/orise/educ.htm), on the ORAU home page at [www.ornl.org](http://www.ornl.org), or by contacting either of the following:

R. Larry Dooley, Associate Dean of Research and Graduate Studies; ORAU Councilor for Clemson University

Monnie E. Champion, ORAU Corporate Secretary, 865-576-3306

ORAU's Office of Partnership Development seeks opportunities for partnerships and alliances among ORAU's members, private industry, and major federal facilities. Activities include faculty development programs, such as the Ralph E. Powe Junior Faculty Enhancement Awards, the Visiting Industrial Scholars Program, consortium research funding initiatives, faculty research and support programs as well as services to chief research officers.

### Institute on Family and Neighborhood Life

The Institute on Family and Neighborhood Life generates, shares, and applies the knowledge needed to strengthen ties between families and communities. IFNL's work is based on the premise that help is most acceptable, efficient, and effective when it is "built in," so that it is a part of everyday life. IFNL's research focuses on the everyday experience of chil-

dren, youth, and adults in neighborhood institutions, such as schools, workplaces, religious organizations, civic organizations, and justice-system agencies. IFNL faculty seek to provide the knowledge necessary to enable those institutions to ensure respect for individual dignity, enhance "natural" social assistance, build a sense of community, promote civic participation, and encourage family and neighborhood responsibility. They also strive to understand ways that public policy supports or hinders families and neighborhoods in these tasks and to offer alternatives that foster the creation of neighborly ("family-friendly") communities.

To accomplish these goals, IFNL works at all levels from neighborhood to global, in part because a comparative perspective offers new insights in understanding grassroots phenomena in neighborhoods and developing effective responses in public policy and community-development practice. IFNL is a Key Institution in Childwatch International, a global network of child research centers. IFNL also has partnerships for research, public service, and graduate education with universities in Armenia, the Czech Republic, the Dominican Republic, Estonia, India, South Africa, and Thailand.

### Robert H. Brooks Research Institute for Sports Science

Founded in 1994 through a \$2.5 million pledge from alumnus Robert H. Brooks, the Brooks Research Institute supports interdisciplinary teaching, research, and student learning opportunities in the thriving sports, recreation, and leisure industries. The Brooks Institute is distinctive for its focus on the study of sports from a technological, managerial, and cultural perspective as opposed to the psychological aspects of individual sports participation.

The goals of the institute are

- to support an interdisciplinary focus on sports science that incorporates the broad areas of engineering and science, business, marketing, and communication
- to facilitate faculty work in cross-disciplinary teams
- to provide sports-related academic courses, hands-on research opportunities, cooperative education, and internship opportunities for undergraduate and graduate students
- to promote career opportunities for Clemson graduates in the sports industry.

### Robert J. Rutland Center for Ethics

The Robert J. Rutland Center for Ethics provides the campus and the community with a forum for exploration and discussion of ethical issues in campus and community life. In addition, the Center offers programs and sponsors activities aimed at the development in students, faculty, and members of the community the wherewithal to deal systematically, reflectively, and responsibly with the ethical issues that pervade human life and action.

Both purposes are in keeping with the mission and guiding principles of Clemson University. According to Clemson's mission statement, "Academic institutions exist for the transmission of knowledge, the pursuit of truth, the intellectual and ethical development of students, and the general well-being

of society." The guiding principles indicate that Clemson's educational goals for all students include "developing their communication and critical thinking skills, ethical judgement, global awareness, and scientific and technological knowledge." The Rutland Center for Ethics is dedicated to nurturing an ethical environment on and off campus.

### South Carolina Institute for Energy Studies

The South Carolina Institute for Energy Studies (SCIES) is a state-chartered research and development organization established in 1981 via the SC-82 General Appropriations Act. SCIES is administratively housed at Clemson University.

The objectives of SCIES are

- to promote energy research and development in and for the state
- to transfer energy technology developed by others to South Carolina applications
- to contribute to national energy issues in areas of excellence
- to promote statewide energy education activities.

To accomplish the objectives, SCIES may interact with all departments the University, all colleges within South Carolina, state agencies, federal agencies, and private industry throughout the nation.

### Spiro Center for Entrepreneurial Leadership

Entrepreneurship is the process of recognizing an opportunity and organizing a response under uncertain conditions and with limited resources. The Spiro Center for Entrepreneurial Leadership, a unit within the College of Business and Behavior Science, was created in 1995 with an endowment gift from Clemson University graduate Arthur M. Spiro. The mission of the Center is "to support education, research, and outreach programs that promote entrepreneurial activity and economic development in the region, state, and nation." The Center is committed to an interdisciplinary approach to entrepreneurship at Clemson University and supports research into entrepreneurship topics, provides educational programs for undergraduate and graduate students from all colleges, and conducts outreach activities that provide assistance to inventors and entrepreneurs in South Carolina and the region.

### Strom Thurmond Institute

The Strom Thurmond Institute of Government and Public Affairs conducts applied research in public policy areas, drawing on the expertise of faculty, staff, and students from all colleges at Clemson University. The Institute is organized into two centers and several self-directed teams which assess opportunities, develop projects, form partnerships, and deliver programs to the public and clients of the Thurmond Institute. Graduate research opportunities include natural resource policy, remote sensing, GIS and urban growth modeling through the SC Water Resources Center; demographic projections, return on public invest assessments, education finance policy, and organizational networks through the Jim Self Center on the Future; and fiscal policy, civic engagement, pricing public goods, and governmental organizational structures through



Institute work groups. Preference is given to students enrolled in Clemson's interdisciplinary PhD program in Policy Studies.

### Traveling Scholars Program

Doctoral students at participating universities can benefit from membership in the Inter-Institutional Academic Collaborative (IAC) involving universities of the Atlantic Coast Conference (ACC). Through the IAC, students have unique educational opportunities at participating ACC universities without change in registration or increase in tuition. Academic visits can vary from two weeks to two semesters. Any regularly admitted graduate student in good standing in a doctoral degree program may apply. A limited number of relocation stipends of up to \$1000 per individual are available upon application; however, it is not necessary to win a stipend to participate in the program.

Currently, Clemson University, Duke University, Florida State University, Georgia Institute of Technology, University of Maryland, North Carolina State University, University of North Carolina, University of Virginia, and Wake Forest University participate in the IAC.

Interested students should consult their advisors, who will evaluate the value of the IAC program and determine if the opportunity is not available at Clemson. Once eligibility and opportunity have been determined, the applicant and advisor will contact proper faculty at the proposed host university. If an agreement is reached and space and facilities are available, the applicant and advisor compose and sign a formal application to the IAC Traveling Scholars Program, available on the Web at [www.grad.clemson.edu](http://www.grad.clemson.edu).

## ENROLLMENT OPPORTUNITIES

### Distance Education

Though most degree programs offered by the University are available on campus, Clemson sponsors programs designed to serve the needs of off-campus students. Distance Education courses and programs are available through satellite broadcast, videoconference broadcast, videotape, and the Internet. Courses broadcast through the SC-ETV satellite system (one-way video and two-way audio) can be received at approximately 2,000 locations in South Carolina and more across the nation. These courses are routinely received at locations in Aiken, Beaufort, Charleston, Columbia, Florence, Greenville, Greenwood, and Rock Hill. Remote site students can interact with the instructor via telephone.

Courses using the videoconferencing technology have the advantage of synchronous two-way video and two-way audio connections. Videoconference studios are available in Clemson, Charleston, Columbia, Greenville, and Greenwood.

Courses taught through videotape and the Internet offer the most flexibility for students. These classes do not meet, but students interact with teachers and other students through e-mail, electronic discussion forums, and telephone.

Courses and programs taught in traditional face-to-face classrooms are available in Greenville and Greenwood. In Greenville, courses are taught at the University Center of Greenville. In Greenwood, courses are taught through the Lander-Clemson Graduate Center at Lander University.

Additional information is available from the Office of Off-campus, Distance, and Continuing Education or on the Web at [odce.clemson.edu/](http://odce.clemson.edu/).

### University Center of Greenville

The University Center of Greenville is a consortium of seven South Carolina universities offering degree programs in Greenville. In addition to Clemson University, the consortium includes Furman University, Lander University, the Medical University of South Carolina, South Carolina State University, the University of South Carolina, and the University of South Carolina at Spartanburg.

The Center is housed at McAlister Square Mall on South Pleasantburg Drive in Greenville. Member institutions maintain offices at the site to serve students' needs, and support personnel are on site during all class times.

The facility has a virtual library with 50 Dell computers, six computer labs, six distance education studios, a 120-seat auditorium, and 40 classrooms. All classrooms are equipped with TV/VCR, overhead projectors, and Internet access. Eight smart classrooms are available.

Classes are conducted Monday–Saturday during day and evening hours. Business hours are 9:00 A.M.–6:00 P.M., Monday–Thursday and 8:30 A.M.–1:00 P.M. on Friday. The library is open 9:00 A.M.–5:30 P.M. on Saturday and 1:00–5:30 P.M. on Sunday.

Currently, 19 bachelor's degrees, 25 master's degrees, and two doctorates are available on-site in Greenville from the seven universities. Clemson offers nine degree programs at the Center.

Additional information is available on the Web at [www.greenville.org](http://www.greenville.org).

### Professional Development Programs

The College of Health, Education, and Human Development sponsors professional development programs for teachers and other working professionals. Courses for teachers are offered for academic credit and are coordinated through the school districts. Other professional development programs in engineering, textiles, management, and leadership are available in a noncredit format through the office of Off-Campus, Distance, and Continuing Education. For more information, call (864) 656-2200 or visit [odce.clemson.edu/](http://odce.clemson.edu/).

### Study Abroad

All Clemson University students are encouraged to enroll in courses designed to expand their knowledge and understanding of world affairs. The opportunity to study abroad, while essentially a component of the undergraduate curriculum, is encouraged in many graduate programs. Graduate students in Architecture, for example, spend a semester at the Charles E. Daniel Center for Building Research and Urban Studies in Genoa, Italy. Students in the Master of Business Administration program may study full time or part time in Asolo, Italy, and at the University of Newcastle in Australia. Additional information is available from academic departments and through the Study Abroad Office in E-306 Martin Hall.

Degree Program	Delivery
Education Specialist in Administration and Supervision	University Center of Greenville
Doctor of Philosophy in Educational Leadership	Internet Lander University Coastal Carolina University
Master of Arts in Teaching in Middle Grades Education	University Center of Greenville
Master of Business Administration	University Center of Greenville
Master of Construction Science and Management	University Center of Greenville videotape
Master of Education in Administration and Supervision	Lander University University Center of Greenville
Master of Education in Counselor Education	University Center of Greenville
Master of Education in Reading	Internet
Master of Engineering in Electrical Engineering	satellite broadcast
Master of Human Resource Development	Internet University Center of Greenville
Master of Public Administration	University Center of Greenville videoconference
Master of Science in Nursing	Internet (selected courses only) University Center of Greenville
Master of Science in Youth Development	Internet

See individual department descriptions for program details.



## Academic Common Market

The state of South Carolina, through its membership in the Southern Regional Education Board (SREB), authorizes its public universities to participate in the Academic Common Market (ACM). Under this program, students who are not residents of South Carolina may enroll in selected graduate programs at Clemson University and pay academic fees appropriate for South Carolina residents provided the following conditions are met:

1) The student's state of legal residence must be Alaska, Alabama, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Oklahoma, Tennessee, Texas, Virginia, or West Virginia.

2) The desired program of study must be the PhD program in Industrial/Organizational Psychology or Parks, Recreation, and Tourism Management; the MA program in Professional Communication; the Master of Fine Arts in Digital Production Arts program; the MS program in Applied Psychology, Applied Sociology, Architecture, Packaging Science, Bioengineering, or Textiles, Fiber and Polymer Science; the master's program in Construction Science and Management (MCSM); or the professional master's program in Parks, Recreation, and Tourism Management (MPRTM).

3) The Coordinating Board in the state of the student's legal residence must have selected the program for its residents.

Programs offered by Clemson University are subject to change without notice; however, if the University removes a program from the ACM, students enrolled in that program under the ACM provisions at the time are entitled to continue and receive benefits, provided they are continuously enrolled (summers excepted) and remain in good academic standing. The state coordinator for the Academic Common Market in South Carolina is the Commission on Higher Education.

## DEGREE PROGRAMS ADMINISTERED BY THE GRADUATE SCHOOL

### POLICY STUDIES Doctor of Philosophy Certificate

Clemson University offers graduate studies leading to a PhD degree and a Certificate in Policy Studies. Graduate work in policy studies enables a student to attain a high degree of specialized competence in policy analysis and to secure a mastery of policy research, emphasizing quantitative and economic skills. Government, industry, public policy "think tanks," and other policy research organizations, nonprofit organizations, and universities offer challenging opportunities in policy analysis, issue development, education, and related areas for persons with advanced training.

Special emphasis in the graduate program is placed on quantitative, economic, and political organization as well as other social science skills in the analysis and development of policy. Fundamental and rigorous quantitative and analytical skills for effective policy analysis are developed through core courses in political economy for public policy, ethics, statistical methods for policy research, demographic projections and spatial analysis, policy analysis and political choice, organizational theory and management, applied economics, and a policy analysis workshop. PhD students also select a concentration in Agricultural Policy, Environmental and Natural Resource Policy, Rural and Economic Development Policy, or Science and Technology. Flexibility is also achieved through enrichment, electives, leadership development courses, and the selection of a PhD dissertation topic. The program consists of a minimum of 63 credit hours beyond the bachelor's degree, of which up to 24 credits may be drawn from master's degree and other postgraduate work. There is no language requirement for the PhD degree in Policy Studies.

The graduate program in Policy Studies also offers students enrolled in related master's and doctoral programs the opportunity to gain competence in and understanding of policy analysis. Depending on students' backgrounds and academic preparation, they may supplement their primary master's coursework with a Certificate in Policy Studies. The Certificate in Policy Studies is designed to equip students with a set of explicit public policy research and analytical skills to augment their preparation in a traditional master's program. The certificate program involves 15–18 credit hours of coursework, depending upon the students' academic background and preparation.

The faculty in Policy Studies encourages applications for the PhD program from recipients of a master's degree who wish to acquire policy research and analytical skills in economic development, agriculture, natural resource allocation, rural development, small town and community development, tourism development, environmental issues, land use, infrastructure, public finance, growth management, and science and technology. Master's-level students with similar interests are encouraged to enhance their graduate studies with a Certificate in Policy Studies.

The faculty encourages applications from students who have backgrounds that will facilitate an interdisciplinary course of study. In many cases, students may be admitted to full graduate status in the PhD program without prerequisites other than those required of all graduate students.



# DEGREE PROGRAMS

Major Code	Major	Degree	Department	Department Chair
<b>College of Agriculture, Forestry, and Life Sciences</b>				
103	Agricultural and Applied Economics	MS	Applied Economics and Statistics	Hoke Hill
105	Agricultural Education	MAGEd	Agricultural and Biological Engineering	Harold Allen
114	Animal and Veterinary Sciences	MS, PhD	Animal and Veterinary Sciences	A. B. Bodine
122	Applied Economics*	PhD	Applied Economics and Statistics	Hoke Hill
805	Biochemistry and Molecular Biology	MS, PhD	Genetics, Biochemistry, and Life Science Studies	Richard Hilderman
106	Biosystems Engineering*	MS, PhD	Agricultural and Biological Engineering	Harold Allen
148	Entomology	MS, PhD	Entomology, Soils, and Plant Sciences	Joe Culin
150	Environmental Toxicology*	MS, PhD	Forestry and Natural Resources	Patricia Layton
153	Food, Nutrition, and Culinary Sciences	MS	Food Science and Human Nutrition	Johnny McGregor
156	Food Technology	PhD	Food Science and Human Nutrition	Johnny McGregor
920	Forest Resources	MFR, MS, PhD	Forestry and Natural Resources	Patricia Layton
825	Genetics	MS, PhD	Genetics, Biochemistry, and Life Science Studies	Richard Hilderman
865	Microbiology	MS, PhD	Biological Sciences	Alfred Wheeler
180	Packaging Science	MS	Packaging Science	Ronald Thomas
113	Plant and Environmental Sciences	MS, PhD	Biological Sciences	Alfred Wheeler
			Entomology, Soils, and Plant Sciences	Joe Culin
			Horticulture	Ted Whitwell
125	Wildlife and Fisheries Biology	MS	Forestry and Natural Resources	Patricia Layton
124	Wildlife and Fisheries Biology	PhD	Forestry and Natural Resources	Patricia Layton
899	Zoology	MS, PhD	Biological Sciences	Alfred Wheeler

## College of Architecture, Arts, and Humanities

205	Architecture	MArch, MS	School of Architecture	vacant
213	City and Regional Planning	MCRP	Planning and Landscape Architecture	Daniel Nadenicek
210	Construction Science and Management	MCSM	Construction Science and Management	vacant
822	Digital Production Arts*	MFA	Digital Production Arts	John Kundert-Gibbs
620	English	MA	English	Mark Charney
214	Environmental Design and Planning	PhD	Planning and Landscape Architecture	Daniel Nadenicek
208	Historic Preservation	MS	Planning and Landscape Architecture	Daniel Nadenicek
635	History	MA	History	Tom Kuehn
230	Landscape Architecture	MLA	Planning and Landscape Architecture	Daniel Nadenicek
663	Professional Communication	MA	English	Mark Charney
212	Real Estate Development*	MRED	Planning and Landscape Architecture	Daniel Nadenicek
615	Rhetorics, Communication, and Information Design*	PhD	Art, Communication Studies, English	Victor Vitanza
240	Visual Arts	MFA	Art	Mike Vatalaro

## College of Business and Behavioral Science

505	Accounting	MPAcc	Accountancy and Legal Studies	Ralph Welton
122	Applied Economics*	PhD	Economics	Raymond Sauer
605	Applied Psychology	MS	Psychology	James McCubbin
607	Applied Sociology	MS	Sociology	Kinly Sturkie
509	Business Administration	MBA	Business Administration	Dudley Blair
511	Economics	MA	Economics	Raymond Sauer
512	Electronic Commerce*	MEC	Business Administration	Dudley Blair
514	Graphic Communications	MS	Graphic Communications	Sam Ingram
639	Human Factors Psychology	PhD	Psychology	James McCubbin
638	Industrial/Organizational Psychology	PhD	Psychology	James McCubbin
529	Management	MS, PhD	Management	Terry Leap
670	Public Administration	MPA	Political Science	William Lasser
212	Real Estate Development*	MRED	Finance	Robert McElreath



Major Code	Major	Degree	Department	Department Chair
<b>College of Engineering and Science</b>				
405	Bioengineering	MS, PhD	Bioengineering	Martine LaBerge
106	Biosystems Engineering*	MS, PhD	Agricultural and Biological Engineering	Harold Allen
415	Chemical Engineering	MS, PhD	Chemical Engineering	James Goodwin
816	Chemistry	MS, PhD	Chemistry	Luis Echegoyen
420	Civil Engineering	MS, PhD	Civil Engineering	Nadim Aziz
423	Computer Engineering	MS, PhD	Electrical and Computer Engineering	John Gowdy
820	Computer Science	MS, PhD	Computer Science	Pradip Srimani
822	Digital Production Arts*	MFA	Computer Science	John Kundert-Gibbs
425	Electrical Engineering	MEngr, MS, PhD	Electrical and Computer Engineering	John Gowdy
512	Electronic Commerce*	MEC	Computer Science	Pradip Srimani
440	Environmental Engineering and Science	MEngr, MS, PhD	Environmental Engineering	Alan Elzerman
441	Environmental Engineering and Science (Environmental Health Physics Concentration)	MS	Environmental Engineering	Alan Elzerman
150	Environmental Toxicology*	MS, PhD	Environmental Toxicology	John Rodgers
832	Hydrogeology	MS	Geological Sciences	Alan Elzerman
445	Industrial Engineering	MS, PhD	Industrial Engineering	A. Gramopadhye
450	Materials Science and Engineering	MS, PhD	Materials Science and Engineering	Kathleen Richardson
851	Mathematical Sciences	MS, PhD	Mathematical Sciences	Robert Taylor
455	Mechanical Engineering	MS, PhD	Mechanical Engineering	Imtiaz Haque
871	Physics	MS, PhD	Physics and Astronomy	Peter Barnes
545	Textiles, Fiber and Polymer Science	MS, PhD	Materials Science and Engineering	Kathleen Richardson

### College of Health, Education, and Human Development

303	Administration and Supervision	MEd, EdS	Leadership, Technology, and Counselor Education	Richard Blackburn
313	Career and Technology Education	MCTE	Leadership, Technology, and Counselor Education	Richard Blackburn
380	Career and Technology Education	EdD	Leadership, Technology, and Counselor Education	Richard Blackburn
311	Counselor Education (Community Counseling)	MEd	Leadership, Technology, and Counselor Education	Richard Blackburn
306	Counselor Education (School Counseling)	MEd	Leadership, Technology, and Counselor Education	Richard Blackburn
312	Counselor Education (Student Affairs)	MEd	Leadership, Technology, and Counselor Education	Richard Blackburn
307	Curriculum and Instruction	PhD	Teacher Education	William Fisk
309	Educational Leadership	PhD	Leadership, Technology, and Counselor Education	Richard Blackburn
310	Elementary Education	MEd	Teacher Education	William Fisk
327	Human Resource Development	MHRD	Leadership, Technology, and Counselor Education	Richard Blackburn
304	Middle Grades Education	MAT	Teacher Education	William Fisk
710	Nursing	MS	Nursing	Kaye Herth
960	Parks, Recreation, and Tourism Management	MPRTM, MS, PhD	Parks, Recreation, and Tourism Management	Brett Wright
324	Reading	MEd	Teacher Education	William Fisk
347	Secondary Education (English)	MEd	Teacher Education	William Fisk
350	Secondary Education (History)	MEd	Teacher Education	William Fisk
353	Secondary Education (Mathematics)	MEd	Teacher Education	William Fisk
365	Secondary Education (Natural Science)	MEd	Teacher Education	William Fisk
378	Special Education	MEd	Teacher Education	William Fisk
383	Youth Development*	MS	Health, Education, and Human Development	Brenda Thames

### Graduate School

110	Policy Studies*	PhD	Strom Thurmond Institute	Bruce Ransom
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\*Interdisciplinary program



## COLLEGE OF AGRICULTURE, FORESTRY, AND LIFE SCIENCES

The College of Agriculture, Forestry, and Life Sciences offers graduate programs in 17 traditional disciplines in agriculture, forestry, and a wide variety of biological sciences, from the fundamental to the applied. The college awards the MS and PhD degrees as well as the Master of Agricultural Education and Master of Forest Resources professional degrees. These postbaccalaureate degree programs are designed primarily to provide continuing education for individuals whose interests lie outside a research-oriented profession.

The program in Applied Economics is a cooperative effort between the Department of Applied Economics and Statistics and the Department of Economics in the College of Business and Behavioral Science. The programs in Biosystems Engineering and Environmental Toxicology are jointly administered with the College of Engineering and Science.

Through cooperative programs with state, federal, and private agencies, students can extend their research off campus to the Greenwood Genetics Center, research and education centers spanning South Carolina, and state and national forests of the Savannah River Basin. Proximity to the Blue Ridge Mountains provides access to one of the most biologically diverse regions of the world.

Courses are offered in experimental statistics and agricultural mechanization to provide minors for students in other areas and in biological sciences, biology instruction, community and rural development, rural sociology, nutrition, botany, crop and soil environmental science, horticulture, plant pathology, and plant physiology to provide electives for students in other areas.

## AGRICULTURAL AND APPLIED ECONOMICS

### Master of Science

Graduate work in Agricultural and Applied Economics enables the student to attain a higher degree of specialized professional competence and to secure a greater mastery of techniques for applying quantitative economic analysis to agricultural economic development and natural resource problems. Industry, government, and universities offer challenging opportunities in research, development, education, management, and other related areas for individuals with advanced training.

Special emphasis in the graduate program is placed on the economics of agricultural production and marketing, economic development, analysis of government programs and policies, and statistical techniques used in solving economic and institutional problems. Flexibility is achieved through choice of elective courses and selection of a master's thesis or doctoral dissertation topic. A nonthesis option is available as well. There is no language requirement.

In addition to applicants with baccalaureate degrees in agricultural economics and related programs, the department encourages applications from students who have a sound background in general economics. In many cases, such students may be admitted to full graduate status without prerequisites other than those required of all graduate students.

## AGRICULTURAL EDUCATION

### Master of Agricultural Education

The Master of Agricultural Education is a professional degree designed to enhance the human resource skills in agriculture and education. The flexible program provides a core of planning, delivery, evaluation, and administrative strategies while encouraging specialization in teacher education, adult and extension education, agricultural communications, youth development, or technology transfer. Graduates hold positions as agriculture teachers, extension agents, agricultural and environmental agency employees, as well as human resource development specialists in the agricultural industry.

Candidates for the degree are required to plan an individual program of study in consultation with the major advisor and graduate committee; complete a minimum of three credit hours in adult education, three hours in research methods, and three hours in statistics; complete a minimum of 12 credit hours in the major field; and complete a minimum of six credit hours in an area of concentration outside the major field.

A minimum of 30 credit hours is required for the professional degree. At least one-half of these credit hours must be selected from courses numbered 700 or above. The student's program of study must be approved by the advisory committee.

### Admission Requirements

Students must complete all University application requirements; have an undergraduate grade-point ratio of 3.0 on the last 60 hours of the bachelor's degree; participate in an interview with a departmental graduate committee; submit a written sample on a topic assigned by the interview committee; and submit acceptable GRE scores. Students with overall grade-point ratios of 2.51–2.9 will be required to take the GRE and complete six hours of graduate coursework with a grade-point ratio of 4.0.

*Note:* Additional undergraduate coursework may be required to obtain teacher certification.

## ANIMAL AND VETERINARY SCIENCES

### Master of Science

### Doctor of Philosophy

Applicants to the Animal and Veterinary Sciences programs should have a strong background in the animal, biological, and physical sciences. Students with deficiencies in these sciences may be admitted provided they correct these deficiencies during the first year of the program of study.

Students enrolled in the MS program are required to complete coursework in areas of the student's interest as approved by the graduate advisory committee. The student's academic program and research emphasize a study of physiological processes, particularly those relating to reproduction, endocrinology, immunology, digestion, and environmental factors. A thesis or dissertation is required.

The PhD degree does not have formal coursework requirements, but it is recognized that students will have individual deficiencies; therefore, it is the responsibility of the student and his/her major advisor, in consultation with the graduate advisory committee, to prescribe coursework to correct these deficiencies. All students majoring in Animal and Veterinary Sciences are required to complete AN PH 851.

The following courses offered by various departments represent possible electives for students in Animal and Veterinary Sciences: AVS 600, 653, 655, 661, 803, 825, BIOCH 606, 623, 633, 634, 815, BIOSC 632, 633, 659, 660, 661, 668, 670, 671, 672, 675, 676, 677, (AVS) 680, ENT (BIOSC) 636, EX ST 801, 803, 805, MICRO (AVS, BIOSC) 614, 811.

## APPLIED ECONOMICS

### Doctor of Philosophy

The graduate program in Applied Economics utilizes the facilities and faculty of the Department of Applied Economics and Statistics and the Department of Economics in the College of Business and Behavioral Science. Students may carry out their dissertation research under the direction of a faculty member from either department. See page 55 for the complete program.



## BIOCHEMISTRY AND MOLECULAR BIOLOGY

### Master of Science

### Doctor of Philosophy

Enrollment in the Biochemistry and Molecular Biology program is open to students with baccalaureate degrees in agricultural, biological, or physical sciences or engineering. Entering students must have satisfactory academic records in mathematical, physical, and biological sciences. Students with deficiencies may be admitted but will be required to correct these deficiencies during the first year.

#### Degree Requirements

For the MS degree, 26 credit hours are required; for the PhD, 30 credit hours are required. Both programs require the following core courses: BIOCH (GEN) 805, (GEN) 810, 814, GEN (BIOCH) 820.

The student, with the guidance of the advisory committee, will select elective courses (nine hours for the MS degree, 12 hours for the PhD degree) from the following: BIOCH 643, 816, 818, 821, 822, 828, 832, 890, GEN 640, 650, 670, 801, 803, 815, 830, 890.

MS candidates will present seminars (BIOCH (GEN) 851) twice, PhD candidates three times. All graduate students are required to attend GEN (BIOCH) 825 or deliver seminars (BIOCH (GEN) 851) every semester they are enrolled.

A minimum of six credit hours of research, culminating in a thesis, is required of master's candidates. Successful completion of written and oral comprehensive examinations will admit the doctoral students to candidacy for the PhD degree.

## BIOSYSTEMS ENGINEERING

### Master of Science

### Doctor of Philosophy

This program is administered jointly with the College of Engineering and Science. See page 58 for the complete program.

## ENTOMOLOGY

### Master of Science

### Doctor of Philosophy

The Entomology graduate programs of the Department of Entomology, Soils, and Plant Sciences are dedicated to providing leadership in environmental entomology. Research programs fall into four emphasis areas: arthropod biodiversity, agricultural entomology, genetics and biotechnology, and urban entomology. Facilities of the South Carolina Experiment Station on campus and at four research and education centers located in various regions of the state are available for graduate student research. In addition to teaching and research laboratories, specialized facilities within the department include the Clemson University Arthropod Collection; laboratories for molecular genetics, tissue culture, and analytical chemistry/toxicology; wet laboratories; controlled and ambient temperature insect-rearing fa-

cilities; a free-flight butterfly facility; and greenhouses. Candidates for the MS degree must complete 30 hours of graduate credit, including six hours of research, and write a thesis. Candidates for the PhD degree must complete 18 hours of dissertation research and write a dissertation.

## ENVIRONMENTAL TOXICOLOGY

### Master of Science

### Doctor of Philosophy

Environmental toxicology is the scientific study of chemical, physical, and biological stimuli in environments and the effects of these stimuli on living systems and their external and internal physical, chemical, and biological integrity. Emphases include the metabolism of contaminants, their decomposition, fate, and effects in aquatic and terrestrial environments. This interdisciplinary program provides a strong background in fundamental environmental toxicology and ecotoxicology. The program is administered jointly with the College of Engineering and Science.

Students with baccalaureate degrees in the basic and life sciences, agriculture, or engineering may be admitted. Strong faculty expertise and areas of student specialization are available in wildlife toxicology, environmental chemistry, biochemical and mechanistic toxicology, ecological modeling, ecological risk assessment, and biological control. Each student's research program is designed to meet his/her professional goals.

Candidates for the MS degree must complete 30 hours of graduate credit, including six hours of research, and write a thesis. Candidates for the PhD degree must complete 18 hours of dissertation research and write a dissertation.

Graduate research programs are conducted in conjunction with the Clemson Institute of Environmental Toxicology, providing a unique and innovative environment for graduate education. Collaborative research opportunities exist nationally and internationally with other universities, state and federal agencies, and industrial groups.

## FOOD, NUTRITION, AND CULINARY SCIENCES

### Master of Science

Detailed information is available from the Department of Food Science and Human Nutrition or on the Web at [www.clemson.edu/foodscience/](http://www.clemson.edu/foodscience/).

#### Admission Requirements

Students admitted to the MS program in Food, Nutrition, and Culinary Sciences must meet the criteria outlined below. Students not meeting the minimum admission requirements may be admitted in a provisional status with the approval of the graduate faculty.

1. The Aptitude Test of the Graduate Record Examination (GRE General Test) must be taken by all applicants. A minimum total GRE score of 1000 on the two-component exam is required. In some

cases, other tests administered for students applying for postbaccalaureate degrees may be accepted in lieu of the GRE (e.g., MCAT).

2. A strong background in food science; human nutrition; physical, chemical, or biological sciences; or engineering is highly desirable.

3. Proficiency in food science must be demonstrated by satisfactory completion of coursework in the following areas: food chemistry, food microbiology, food processing, and biochemistry. Background course requirements will normally be satisfied with completion of a BS degree in Food Science from an accredited institution. Students deficient in any of these areas will be required to complete coursework to fulfill these background course requirements.

4. Acceptance is based upon academic transcripts with a minimum undergraduate grade-point ratio of 3.0, three letters of recommendation, a statement of objectives and professional experience.

5. International students must have a minimum Test of English as a Foreign Language (TOEFL) score of 575. International applicants must also submit documentation of adequate financial support for their studies.

6. An additional requirement for admission is identification of a research advisor prepared to accept the applicant as an advisee.

#### Financial Aid

A limited number of research assistantships are available from grant funds, with the student assisting in the research supported under the grant. This research often may be applicable to the thesis or dissertation. Interested applicants should contact individual faculty for research assistantships. Applicants whose files are completed prior to February 15, 2006, will be given preferential consideration for research assistantships offered beginning fall semester 2006.

#### Transfer of Credits

With preapproval, up to eight graduate credits may be transferred into the MS program. A grade of B or better is required in each course transferred.

#### Course Requirements

A minimum of 24 credit hours of coursework and six credit hours of thesis research (FD SC 891) is required for the graduate degree. Only 600-level courses and higher may be used for graduate credit, and at least one-half of the 24 hours of coursework must be at the 800-level or higher.

The following courses are required: EX ST 801 or equivalent, FD SC 851 (one-credit hour seminar each spring), 18 credit hours of advanced-level courses (may include courses in food science or in areas such as chemistry, nutrition, biochemistry, animal and veterinary sciences, microbiology, statistics, or cell biology, as required by the student's Graduate Advisory Committee), and six credit hours of thesis research (FD SC 891).

In addition, a minimum grade-point ratio of 3.0 is required to maintain good academic standing and for graduation.



## **Combined Bachelor of Science in Food Science/Master of Science in Food, Nutrition, and Culinary Sciences**

Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements. Enrollment guidelines and procedures can be found under *Academic Regulations* in this catalog. Consult the Department of Food Science and Human Nutrition for details.

## **FOOD TECHNOLOGY**

### **Doctor of Philosophy**

There are no set course requirements for the doctorate in Food Technology. It is expected that each PhD graduate will have a comprehensive understanding of the principles of food science with an expanded knowledge covering their focused research area. The PhD candidate's research committee will have final approval on all coursework. PhD candidates must pass both written and oral examinations given by the student's advisory committee. The successful student must also write a research dissertation and defend that dissertation to the satisfaction of the advisory committee.

PhD students are required to pass a written and oral qualifying exam administered by the advisory committee. PhD students are also required to pass a final oral dissertation defense.

#### **Dissertations**

Dissertations are usually longer and also normally contain a review of the literature. PhD students should expect to publish a minimum of two refereed research manuscripts from their dissertations.

## **FOREST RESOURCES**

### **Master of Forest Resources**

### **Master of Science**

### **Doctor of Philosophy**

Enrollment in the Master of Forest Resources and Master of Science programs is open to students who have earned a baccalaureate degree in forestry, forest products, or a related field. A master's degree, preferably in a forestry discipline, is required for enrollment in the Doctor of Philosophy program. The candidate may be required to satisfy undergraduate deficiencies before being admitted to full status.

The Master of Forest Resources, a nonthesis degree, requires a minimum of 36 credit hours of graduate coursework with at least 18 of the required hours selected from courses numbered 700 or above.

A formal thesis is required for the Master of Science and the Doctor of Philosophy degrees. The Master of Science degree requires a minimum of 24 credit hours of coursework and six hours of research. The Doctor of Philosophy degree requires a minimum of 16 credit hours of coursework and 18 hours of research. For both degrees, one-half of the semester hours must be selected from courses numbered 800 and above.

## **GENETICS**

### **Master of Science**

### **Doctor of Philosophy**

The MS and PhD degrees in Genetics are administered by the Department of Genetics, Biochemistry, and Life Science Studies. Research activities include biochemical, biometrical, molecular, and population genetics, as well as bioinformatics, breeding, cytogenetics, and structural and functional genomics through arrangements with other participating disciplines and with the Greenwood Genetics Center.

#### **Degree Requirements**

For the MS degree, 26 credit hours are required; for the PhD, 30 credit hours are required. Both programs require the following core courses: BIOCH (GEN) 805, (GEN) 810, GEN 814, GEN (BIOCH) 820.

The student, with the guidance of the advisory committee, will select elective courses (nine hours for the MS degree, 12 hours for the PhD degree) from the following: BIOCH 643, 816, 818, 821, 822, 828, 832, 890, GEN 640, 650, 670, 801, 803, 815, 830, 890.

MS candidates will present seminars (BIOCH (GEN) 851) twice, PhD candidates three times. All graduate students are required to attend GEN (BIOCH) 825 or deliver seminars (BIOCH (GEN) 851) every semester they are enrolled.

A minimum of six credit hours of research, culminating in a thesis, is required of master's candidates. Successful completion of written and oral comprehensive examinations will admit the doctoral students to candidacy for the PhD degree.

## **MICROBIOLOGY**

### **Master of Science**

### **Doctor of Philosophy**

Graduate work in microbiology requires sound undergraduate training in the biological and physical sciences. This training may be received in an undergraduate program in biology (botany, microbiology, or zoology), chemistry, or in one of the agricultural sciences. Undergraduate work in bacteriology or microbiology is desirable but not necessary.

All students complete a curriculum that ensures a sound knowledge of the basic areas of microbiology including at least three of the following: bacterial physiology and metabolism, molecular genetics, pathogenic microbiology, virology, immunology and molecular medicine, or applied and environmental microbiology. The program is selected by the student with the guidance and approval of an advisory committee.

Candidates for the MS degree must complete 30 hours of graduate credit, including six hours of research, and present and defend a thesis based on original research.

Candidates for the PhD degree must complete a core curriculum and 18 credit hours of dissertation research and present and defend a dissertation based on original research. Research disciplines include

biomedical research (pathogenic microbiology, immunology, gene therapy, cancer, endocrinology); food safety (molecular biology and production of bacteriocins); and environmental microbiology (bioremediation, rhizosphere microbiology).

## **PACKAGING SCIENCE**

### **Master of Science**

The MS degree program in Packaging Science prepares graduates to work independently in the research, development, and application of new packaging materials and processes. Students may be accepted with backgrounds relating to chemistry, physics, mathematics, biology, or engineering. Students with backgrounds in business or graphic communications or other disciplines may also be accepted after completing courses equivalent to the basic science and mathematics courses in the department's undergraduate curriculum. Each degree program is designed individually to augment the student's background to provide a broad understanding of packaging science and specialized knowledge in the area of the student's research.

The MS degree in Packaging Science requires 30 hours of coursework, six of which are thesis research, and the completion of an acceptable MS thesis. In addition to PKGSC 891, students register for at least one credit of PKGSC 851.

The following courses offered by various departments represent possible electives for the student in packaging science: C M E 815, CH E 612, 804, EX ST 801, 802, FD SC 601, 602, 604, 606, 608, 810, 811, 812, G C 606, 607, 648, MKT 627, 630.

## **PLANT AND ENVIRONMENTAL SCIENCES**

### **Master of Science**

### **Doctor of Philosophy**

The degree programs in Plant and Environmental Sciences are offered through an interdepartmental program comprised of faculty from disciplines including biological sciences, botany, crop science, entomology, genetics, horticulture, plant pathology, plant physiology, and soil science.

Candidates for the program in Plant and Environmental Sciences should have a strong undergraduate background in the biological, agricultural, and/or physical sciences as appropriate to their focus areas. Undergraduate curricula that may provide this background are botany, biology, chemistry, or one of the agricultural plant and soil environmental sciences such as agronomy, forest resources, or horticulture. Students with nontraditional backgrounds may need to complete some relevant undergraduate courses to supplement the graduate program.

Each student's degree program is tailored to his/her professional goals and is guided by an advisor and graduate committee with expertise appropriate to the student's area of specialization. All graduate students must select an advisor before admission.



Candidates for the MS degree must complete 24 credit hours of coursework and six hours of research, and they must present and defend a thesis based on original research. MS students who plan nonresearch-related careers in public gardening, landscape design, extension, consulting, or agribusiness may complete 30 credit hours of coursework and undertake a professional development/public service project option in lieu of thesis-related research. Interdisciplinary studies in plant health and integrated pest management are also available under this option.

A dissertation based on original research is required for the PhD degree. There is no specific credit hour requirement; the plan of coursework is based on the student's interests and dissertation emphasis, as determined in consultation with the major advisor and graduate committee.

Individual plans of study include courses from the following areas: biochemistry, biological sciences, botany, crop and soil environmental science, entomology, genetics, horticulture, and plant pathology as well as plant and environmental sciences.

## WILDLIFE AND FISHERIES BIOLOGY

### Master of Science

#### Doctor of Philosophy

Those who are interested in pursuing a graduate degree in Wildlife and Fisheries Biology should have sound undergraduate training in the biological or related sciences. Initially, applicants should contact the faculty members whose research interests are closest to their own. Programs of study are designed to emphasize relationships between wild animals and their changing environments and production of aquatic organisms.

Admission to either the master's program or the doctoral program requires acceptance by the University and the Graduate Student Admission Committee of Wildlife and Fisheries Biology. This committee will base its acceptance recommendation to the Admissions Office on previous coursework, GRE scores, letters of recommendation, undergraduate background, and current research interests. Students are required to have completed a bachelor's degree, preferably in a natural science, with a minimum of 30 credit hours in natural sciences. In addition, an MS in natural resource biology or related area usually is preferred, but not required, for acceptance into the doctoral program. Students accepted without the appropriate course background will be required to make up these deficiencies as outlined by the Graduate Student Admission Committee and consistent with University admission policies.

Requirements for the MS in Wildlife and Fisheries Biology include 24 credit hours of coursework, six hours of research credits (W F B 891), an acceptable thesis based on original research, and satisfactory performance on a final oral examination. Additional coursework usually includes subjects such as experimental statistics, biological sciences, and forestry. Thesis research areas include aquaculture,

conservation biology, upland and wetland wildlife biology, endangered species biology, freshwater fisheries science, and marine fisheries science.

There are no specific credit hour requirements beyond 30 credit hours of postbaccalaureate coursework and 19 hours of doctoral dissertation research for the PhD in Wildlife and Fisheries Biology; however, the student's advisory committee will insist on a rigorous and appropriate program of study and research. Students are required to take, or have taken, at least two semesters of graduate statistics and two semesters of 800-level seminars in fisheries and wildlife science or related areas. Students must also have a minimum of one semester of professional experience, which will be evaluated by the student's advisory committee. Examples of appropriate professional experience are teaching assistantships, internships or cooperative study program participation, or natural resource agency employment. Other course requirements will be identified by the student's advisory committee and will include specific courses according to the elected emphasis area. The three emphasis areas are fisheries biology, wildlife biology, and conservation biology.

Research opportunities for graduate students are enhanced by cooperative programs with the S.C. Department of Natural Resources, U.S. Fish and Wildlife Service's Cooperative Research Unit at Clemson, Savannah River Ecology Laboratory, Webb Wildlife Research Center, and Waddell Mariculture Center. The department also is associated with the National Council for Air and Stream Improvement Eastern Wildlife Program. The graduate program in Wildlife Biology is accredited by the Southeastern Section of the Wildlife Society.

### Combined Bachelor of Science/ Master of Science Degree Program

Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements.

Students are encouraged to obtain the specific requirements for the dual degree from the Department of Forestry and Natural Resources as early as possible in their undergraduate program as a number of required courses have prerequisites not normally taken by Wildlife and Fisheries Biology majors. Enrollment guidelines and procedures can be found under *Academic Regulations* in this catalog.

## ZOOLOGY

### Master of Science

#### Doctor of Philosophy

The MS and PhD degrees in Zoology are administered by the Department of Biological Sciences. Research areas include cell and developmental biology, vertebrate and invertebrate biology, ichthyology, herpetology, mammalogy, ornithology, behavior, biomechanics, conservation biology, population biology, molecular biology, plant ecology and taxonomy, animal ecology, restoration ecology, evolution, population genetics, comparative immunology, physiology, and toxicology.

Applicants to the graduate degree programs in Zoology must have a bachelor's or master's degree and a sound background in biology. All students are expected to have completed inorganic and organic chemistry, physics, calculus, introductory biology, plant or animal diversity, genetics, cell or developmental biology, physiology, and ecology. Deficiencies (less than 18 hours total) may be remedied through appropriate coursework completed during the graduate program. Graduate credit is not normally awarded for remedial coursework. Students with more than 18 hours of deficiencies, including those with degrees outside of biology, are encouraged to contact the Department of Biological Sciences to discuss options for fulfilling coursework requirements in preparation for application to the MS and PhD programs.

Students seeking the Master of Science degree in Zoology may select either a thesis or nonthesis option. Requirements for the thesis option include 24 credit hours of coursework, six hours of research, an acceptable thesis, and satisfactory performance in a final oral examination. Requirements for the nonthesis option include 36 credit hours of coursework and satisfactory performance on a final comprehensive examination.

Requirements for the PhD degree include written and oral comprehensive examinations, research, a dissertation, and satisfactory performance in a final oral defense. Although there is no required coursework for the doctorate beyond 18 credit hours of research, breadth and depth of preparation in the life sciences are expected of each candidate.



# COLLEGE OF ARCHITECTURE, ARTS, AND HUMANITIES

The College of Architecture, Arts, and Humanities offers graduate programs in three schools: the School of Design and Building, the School of the Arts, and the School of Humanities. Advanced degrees are offered in Architecture; City and Regional Planning; Construction Science and Management; Digital Production Arts; English; Environmental Design and Planning; Historic Preservation; History; Landscape Architecture; Professional Communication; Real Estate Development; Rhetorics, Communication, and Information Design; and Visual Arts.

Courses are offered in art and architectural history, communication studies, geography, languages, literature, performing arts, philosophy, religion, and women's studies to provide electives for students in other areas.

Graduate students in the School of Design and Building and the School of the Arts have the opportunity to study at the Charles E. Daniel Center for Building Research and Urban Studies in Genoa, Italy, which is sponsored jointly by the College and the Clemson Advancement Foundation for Design and Building. Emphasis is placed on studies related to this historic port city and the art and architectural heritage of the Italian setting. Studio and classroom work are enriched by visiting scholars and critics and complemented by scheduled field trips, both in Italy and continental Europe.

Courses of study in the Daniel Center, while under the jurisdiction of the related departments of the College of Architecture, Arts, and Humanities, are administered and taught by the professors-in-residence. Studio work is the core of the Genoa program, whether in architecture, construction science and management, or visual arts. All students undertake a history research project, conduct field studies, and participate in a design seminar.

The School of Humanities houses programs leading to the Master of Arts in English, History, and Professional Communication and the Doctor of Philosophy in Rhetorics, Communication, and Information Design. The school also offers certificate programs in Health Communication and Writing Assessment. Faculty have been recipients of grants from agencies and foundations, such as the National Endowment for the Arts, the National Endowment for the Humanities, the John Simon Guggenheim Memorial Foundation, and the Bingham Trust. They have also held Fulbright Senior Lectureships and Research Awards in many countries.

## ARCHITECTURE

### Master of Architecture

### Master of Science

The Master of Architecture is a professional degree program that develops proficiency in responding to contemporary architectural issues through a range of both practical and theoretical knowledge, while providing opportunities for creatively challenging the limits of the profession. Major emphasis is on design, accompanied by complementary coursework of a professional focus, as well as elective subjects. Complex studio design projects stress social awareness and contextual fit and are responsive to all aspects of the architectural process. Practical experience is a requisite part of the overall program, which is concluded with a thesis or project combining literary research with design synthesis.

Admission to the MArch program is based on the student's ability to respond effectively to the intellectual rigor and creative challenge integral to graduate architecture study. This potential is measured by demonstrated proficiency in prior academic work and Graduate Record Examination (GRE) general test scores, as well as creativeness of mind, motivation of spirit, and maturity of purpose. A postbaccalaureate program of preparatory study is available to qualified applicants with backgrounds in areas other than design. Detailed information is available from the School of Architecture.

The Master of Architecture degree requires a minimum of two academic years. Degree candidates may elect a concentration of study in architecture or architecture and health care. Each student's specific plan of study is determined in consultation with the major advisor and is intended to reflect individual educational objectives and career goals, while assuring a comprehensive development of professional competence. The graduate faculty reviews each student each semester of the first year to determine if his/her performance is acceptable to continue in the program. A standing committee of the graduate faculty will evaluate the oral defense. Requirements for the MArch degree include 60 credit hours of approved coursework with a minimum grade-point ratio of 3.0. Students in the final year have the option of enrolling in the thesis project by taking ARCH 858 (Thesis Research), ARCH 859 (Thesis Manuscript), and ARCH 891 (Thesis Project). Students in the nonthesis option will enroll in elective courses as well as ARCH 892 (Comprehensive Studio).

Students in the Architecture program should be aware that ARCH 859 (Thesis Manuscript) is a graded course and may be taken only once. If a student's final thesis or project is not complete by the end of the semester in which he/she enrolls in ARCH 859, the student should take an *incomplete* in ARCH 859 and enroll in G S 799 while finishing the thesis or project. After the thesis or project is completed, the *incomplete* in ARCH 859 can be converted to a final grade.

### Architecture Concentration

This inclusive course of study leading to the MArch degree allows the student to pursue individual academic and career objectives within the context of a rigorous professionally directed architecture program. The focus of learning is the design studio, where the student is involved in a range of theoretical and real-world explorations. Advanced studies in technology, theory, and professional practice complement design work and are accompanied by additional subjects determined in concert with the major advisor.

Although designated subjects in design and other professional studies constitute a major portion of work in this concentration, sufficient elective hours are available to establish a study plan responsive to individual interests. The choice of thesis provides a further opportunity for personal development.

### Architecture + Health Concentration

Within the framework of the Master of Architecture degree, the Architecture + Health Concentration includes seminar courses and studio work appropriate for both a general professional degree and a concentration in Architecture + Health. The intent is to develop the generalist-specialist—graduates who can creatively work in both modes. This concentration includes both the study of health facility design and the study of relationships between architectural settings and their impact on human health and well-being. The primary purpose of the concentration is to study how architectural environments impact health and how to create architectural settings that support health and well-being of individuals and larger populations.

Studio design projects and courses examine these relationships for architectural settings and conditions ranging from entire communities and health care systems to specific projects and individual interior or exterior spaces. The studio emphasizes design excellence within the framework of rigorous and complex demands found in the practice of health care architecture. Student work is expected to stand up critically at all levels of architectural consideration.

The Architecture + Health Concentration is demanding in the scope of its professional studies, with most of the coursework designated for specific areas of learning. Students may take advantage of the same off-campus programs available to students in the Architecture Concentration during their first semester of study. Given the number of required courses, students may opt for a five-semester plan of study beginning in the spring semester. The thesis or project, developed during the final year, normally deals with particular architectural topics as they relate to health and/or health facility design.

### Master of Science Program

The Master of Science degree in Architecture is a postprofessional degree program which offers the opportunity to achieve advanced learning within the discipline of architecture and to undertake research responsive to increasingly complex challenges attendant to the built environment. This is accomplished through a foundation of coursework, accompanied by directed studies within a selected area, and followed by the critical examination of a singular aspect of architecture in a research thesis.



Admission to the MS program is available to students who have a first professional degree in architecture and who possess the intellectual mettle and dedication necessary to respond successfully to the rigor of advanced study and independent research. This is measured by academic proficiency in prior work, a well-reasoned plan of advanced study, and GRE general test scores. Information concerning application procedures and requirements is available from the School of Architecture.

The coursework and directed studies required of the Master of Science program may be completed in one academic year, after which a variable period of time is dedicated to the research thesis. Degree candidates work within one of the following areas: architecture and health care facilities, environmental issues in architecture, architecture and human perception, or theory and philosophy of architecture. A plan of study is determined in consultation with the major advisor who, along with the advisory committee, periodically reviews the student's work and evaluates the research thesis. Requirements for the MS degree consist of 24 credit hours of combined coursework and directed studies with a minimum grade-point ratio of 3.0 and the acceptance of a six-hour research thesis.

## CITY AND REGIONAL PLANNING

### Master of City and Regional Planning

The two-year Master of City and Regional Planning program is a professional degree emphasizing applied study in preparing tomorrow's leaders for planning and developing the nation's towns, cities, and regions. The curriculum emphasizes applied study preparing for the challenge of planning vibrant and sustainable communities. Graduates are well-equipped for careers in private sector planning and development, as well as public sector planning and administration. The nationally accredited program began in 1968 and has over 400 graduates.

The program emphasizes sustainable land development, applying appropriate technology and recognizing the balance of physical, economic, financial, social, and policy dimensions of planning. The program has a professional application focus mainly concerned with providing a solid planning education to qualified students, primarily to meet the needs of South Carolina, the southeastern region, and the nation. The generalist approach is employed with the flexibility for specialization in four areas: development planning, transportation, environmental land use planning, and geographic information systems. A substantive core emphasizes the general framework, theories, methods, and applications of the planning process. Strong ties with the professional community reinforce the professional application focus.

Students come from a variety of undergraduate majors and professional backgrounds—primarily liberal arts, the social sciences, environmental science, business, management, and design—and from many states and several countries. The MCRP program typically has annual classes of approximately

15–20 students, providing the opportunity for extensive faculty involvement in teaching, research, and public service.

While the curriculum covers theory and policy issues, the principal focus emphasizes the applied skills students need to enter the job market as professional planners and to evolve as leaders in the field. Classes use real-world situations for analysis and for the application of planning skills in dealing with land use planning, development, and issues of the built and natural environment.

Planning students are equipped to meet opportunities facing communities in many creative ways. Many first-year students work two days per week as department assistants for professors or in planning related entities. Students typically work full time as interns in planning or development organizations during the summer between their first and second academic years. During their second year, most students work two days a week with a public, private, or nonprofit entity as student public service assistants (SPSA). This allows them to gain additional professional experience. Students also interact in interdisciplinary teams.

Department assistants generally earn around \$2,500 for nine months at 10 hours per week; SPSAs earn around \$4,000 at 15 hours per week and usually require an automobile for transportation to positions throughout the area. Both assistantships provide significant tuition reduction. Students also have the opportunity to participate with the Center for Community Growth and Change and the Center for Real Estate Development.

Students are actively involved in Clemson's Planning Student Organization of the American Planning Association (APA) and SCAPA. The program director and student president of the Clemson student chapter are both on the SCAPA Executive Committee.

Clemson's graduates have been successful in the public, private, and nonprofit sectors, attaining key positions in traditional planning agencies, development groups, nonprofit organizations, and private consulting firms. This practical, applied program is recognized throughout the region for its outstanding graduates. Most alumni of the program serve as agency directors, department heads, and staff planners at the local, regional, and state levels. Some graduates work as generalists while others are specialists in GIS, housing and community development, environmental and coastal planning, historic preservation, transportation planning, or economic development. A growing number are employed in the private sector as developers, banking professionals, market research and site location analysts, land development and urban design consultants, public-private partnership consultants, and other consulting firms.

#### Admission Requirements

1. A bachelor's degree from an accredited college or university
2. A satisfactory academic record, particularly in the last two years of undergraduate work
3. An on-campus interview (highly recommended)

4. Three letters of recommendation with at least two from current or former professors

5. Completion of the Graduate Record Examination

6. A personal statement of objectives, briefly describing (in one to two pages) the applicant's interest in planning in general and Clemson's program in particular

Courses in statistics and economics are highly recommended. International students are required to submit TOEFL scores.

Deficiencies in any of these areas may be remedied after enrollment in the graduate program. Postbaccalaureate status may be recommended in some cases.

#### Requirements for Degree Candidacy

The two-year Master of City and Regional Planning degree requires a minimum of 55 credit hours. The program contains a 28-credit core curriculum, a three-credit summer internship, 15–18 credit hours of approved concentration/elective courses, and 6–9 hours of research and terminal project or thesis. The core courses include planning and substantive theory, analytical methods, implementation techniques and applications. The concentration area allows the student to develop further expertise in a particular area, if desired. A summer internship between the first and second years requires ten weeks of supervised professional employment for another three credits. If approved, students may take additional coursework in lieu of the internship. An oral examination is required to present and defend the results of the terminal project or thesis.

#### Requirements for Awarding of a Degree

##### Thesis Option

1. A minimum of 55 hours of coursework with a B average in the student's prescribed professional curriculum, including the thesis, is required.

2. A nine-credit-hour planning thesis must be completed satisfactorily. Only those students who have been approved by the Planning faculty and have performed satisfactorily on the comprehensive examination will be permitted this option.

3. The final oral examination requires satisfactory answers to questions concerning the student's thesis and concentration area.

##### Nonthesis Option

1. A minimum of 55 hours of coursework with a B average in the student's prescribed professional curriculum is required.

2. An approved six-credit-hour terminal project sequence must be completed satisfactorily. Students must perform satisfactorily on a comprehensive examination covering the core planning courses before being permitted to write the terminal project.

3. The final oral examination requires satisfactory answers to questions concerning the student's terminal paper and concentration area.



## CONSTRUCTION SCIENCE AND MANAGEMENT

### Master of Construction Science and Management Certificate

The Master of Construction Science and Management program provides students with a high level of skill and understanding in the technical areas of construction project administration and control. Substantial emphasis is placed on advanced study in the field of business, in new and emerging techniques for construction project delivery systems, and in the administration of the construction firm.

The number of credit hours required for the MCSM degree varies according to each entering student's undergraduate degree. For those who have the required undergraduate skills and knowledge, the program consists of 36 credit hours, of which 12 must be from the department core (C S M 860, 861, 862, 863, 864, 865, 891) and C S M 852. In cases where the candidate does not have the necessary prerequisite skills and knowledge, additional coursework beyond the 36 credit hours is required. Each application is evaluated as to the needed additional coursework. If deficient courses are noted, the candidate may be placed in a postbaccalaureate status.

This program is also available to off-campus students through the Office of Off-Campus, Distance, and Continuing Education. Call 1-888-CLEMSON (1-888-253-6766) for more information.

#### Admission Requirements

1. A bachelor's degree in construction science, construction management, building construction, or related area is required. Applicants from other disciplines may be admitted but may be required to remedy any deficiencies in coursework to provide the prerequisite skills and knowledge for the Construction Science and Management graduate program.
2. Acceptance must be granted by the Office of Admissions and the Department of Construction Science and Management. University acceptance is based on performance in previous undergraduate studies and a satisfactory score on the GRE. In addition, acceptance by the department is based on performance in undergraduate studies, three letters of recommendation, and acceptance by the department Graduate Admissions Committee.
3. Each applicant is required to have one year of construction experience prior to being admitted to the program. Applicants must submit a detailed résumé of construction experience.

#### Requirements for Degree Candidacy

1. The Master of Construction Science and Management degree requires a minimum of 36 credit hours as detailed above. In cases where the candidate does not have the necessary undergraduate prerequisite skills and knowledge, additional coursework beyond the 36 semester hours may be required as noted above.
2. Each student is required to have one year of construction-related experience prior to being admitted to the program.

#### Requirements for Awarding of a Degree

##### Thesis Option

1. A minimum of 36 credit hours of coursework with a B average in the student's prescribed curriculum, including thesis, is required.
2. A thesis on a construction-related topic must be completed satisfactorily. Up to nine semester hours of thesis credit may be taken. Thesis credit is included as part of the department's core. Approval must be received from the student's advisor prior to selecting the thesis option.
3. Performance on a final oral examination relating to the student's thesis and program of study must be satisfactory.

##### Nonthesis Option

1. A minimum of 36 credit hours of coursework with a B average in the student's prescribed curriculum is required.
2. Performance on a written comprehensive examination covering the student's program of study must be satisfactory.
3. Performance on a final oral examination relating to the student's program of study must be satisfactory if the student has not performed satisfactorily on the written comprehensive exam. The oral exam is required only if the student did not perform satisfactorily on the written exam.

### Certificate of Construction Science and Management

Clemson University's Certificate Program in Construction Science and Management provides qualified students the opportunity to take a selection of advanced construction management courses without having to commit time and resources toward the pursuit of a master's degree. Students receive three hours of college credit for each course taken and a certificate upon completion of all six courses.

Prospective students apply in the same manner as current graduate students. A bachelor's degree in construction science, construction management, building construction, or related area is required. There is no requirement to take the GRE or TOEFL examination.

A student enrolled in the certificate program who wishes to be admitted into the MCSM graduate program must meet all admission and degree requirements in effect at the time of application. The student may transfer up to 12 credit hours from the certificate program to the Master of Construction Science and Management degree; therefore, the decision must be made by the time the student has completed four courses (12 credit hours).

#### Admission Requirements

1. A bachelor's degree in construction science, construction management, building construction, or related area is required. Applicants from other disciplines may be admitted but may be required to remedy any deficiencies in coursework to provide the applicant with the needed prerequisite skills and knowledge for the Construction Science and Management certificate program.

2. Acceptance must be granted by the Department of Construction Science and Management. Acceptance is based on performance in previous undergraduate studies, three letters of recommendation, and acceptance by the department graduate admissions committee.

3. Each applicant is required to have a minimum of one year of construction experience prior to being admitted to the program. Applicants must submit a detailed résumé of construction experience.

#### Requirements for Awarding of a Certificate

Completion of the following courses with a B or better is required: C S M 860, 861, 862, 863, 864, 865.

## DIGITAL PRODUCTION ARTS

### Master of Fine Arts

The Digital Production Arts program at Clemson University is a professional degree program aimed at producing graduates who will be sought by the growing electronic arts industry, particularly by those companies engaged in special effects production within the entertainment and commercial video, film, and gaming industries. The program is offered jointly with the College of Engineering and Science and offers a unique blend of instruction from art, computer science, computer engineering, graphic communications, performing arts, philosophy, and psychology, together with newly designed courses targeted at specific production techniques.

#### Admission and Financial Aid

Applicants are required to submit GRE general test results and a portfolio of artistic work that may include CD-ROMs, videos, slides, etc. Assistantships will be available to qualified applicants. Interested domestic students are encouraged to apply by March 1 for fall admission.

#### Requirements for Awarding of a Degree

The degree requires 60 hours, 18–24 of which are devoted to the visual arts studio wherein the student participates in group and individual animation projects, providing material for his/her professional quality demonstration video. Of the remaining 36–42 credit hours, 18 must come from the core courses, six from the master's thesis, and 12 from electives or foundation courses, three hours of which must come from one of the required electives below. Some beginning students may need postbaccalaureate work in the fundamentals of computing or visual arts, so foundation courses are offered. A maximum of five hours of foundation courses may be counted toward the degree. The normal course of study requires two years.

*Foundation Courses*—two courses selected from ART 803, CP SC 801

*Core courses*—ART 613, 821, CP SC 605, 611, 815, THEA 687. At least one course must be selected from A A H 630, 632, ENGL 650, (COMM) 651, 853, PHIL 845.

*Electives*—selected from ART 605, 607, 609, 611, CP SC 805, 808, E C E 847, G C 801, MUSIC 680, PSYCH 823, THEA 697



*Individual and/or Group Study Courses*—ART (CP SC) 860 and ART 891 or CP SC 891 (Master's Thesis Research)

A supervisory board consisting of the program director and five faculty—two from Art, two from Computer Science, and one from Performing Arts—administers the program. The degree capitalizes on Clemson's well-known strengths in computer graphics (virtual reality systems), image processing, photography, art, film, and theatrical design.

## ENGLISH

### Master of Arts

#### Certificate

An applicant for the Master of Arts degree in English must present at least 12 credit hours of undergraduate English courses beyond the sophomore level; for the MEd degree in Secondary Education with an emphasis in English, an applicant must present at least nine. Entrance credits should include one course each above the sophomore level in Shakespeare and in English and American literature; students deficient in these may seek provisional admission.

MA students complete 25 credit hours of approved graduate courses and write a thesis, which may be developed with the approval of the Graduate Committee, from any interest area covered by the MA program. The nonthesis option requires 37 credit hours. All students must demonstrate a reading knowledge of an approved foreign language.

At the core of the MA program is a 10-hour requirement, including ENGL 800 and one course from each of the following groups:

*British Literature*—ENGL 805, 808, 811, 814, or an appropriate section of 831

*American Literature*—ENGL 820, 823, or an appropriate section of 831

*Language and Composition*—ENGL 885 (required of graduate teaching assistants), 801, 802, 803, 832, 835, or an appropriate section of 831

MEd students in Secondary Education with an emphasis in English complete a total of 37 graduate credits, including ENGL 685 and 800.

Candidates for the MA and MEd degrees also must demonstrate proficiency in composition and pass a comprehensive oral examination.

#### Certificate in Writing Assessment

The certificate program in Writing Assessment consists of 18 credit hours of coursework. That coursework is flexible depending on the targeted needs of the student. The full certificate requires ENGL 871, three hours in writing, and twelve elective hours selected from ENGL 872, 873, 874, 875, or 876.

## ENVIRONMENTAL DESIGN AND PLANNING

### Doctor of Philosophy

The PhD Program in Environmental Design and Planning is an interdisciplinary, three-year post-master's degree program consisting of 71 hours. In most cases, students enter the program with a master's degree in architecture or landscape architecture, city and regional planning, or construction science. Because of its interdisciplinary orientation, students may be drawn from other disciplines including engineering, business, the social sciences, and humanities. Students from those program areas may be required to take prerequisite coursework. Students with advanced preparation may take slightly less than three years.

The curriculum is divided into five content areas as indicated below. Those content areas include core courses, concentration courses, elective courses, comprehensive examination, and dissertation research. Students will select a field from the traditional disciplines of architecture, landscape architecture, planning, or construction to build disciplinary as well as interdisciplinary foundations. Areas of specialization will be developed subject to faculty expertise and student interest. Areas of specialization might be drawn from such areas as urban design, health care, energy, development, community design, restoration, sustainability, landscape ecology, and building practice and technology.

*Core Courses*—The core consists of 23–26 hours of coursework and includes advanced theory/history, advanced methods courses generally taken outside the college, a readings course within a primary field area, a contemporary issues seminar, courses in research design and instructional delivery, and a colloquium and workshop. The core provides a foundation with some flexibility to tailor curriculum to individual needs within primary fields of study as well as a forum to address issues of the built environment in an interdisciplinary setting.

*Concentration Courses*—These courses may be taken within or outside the college. Students develop an individualized course of study to reflect their focus and career objectives. Coursework must be approved by the faculty advisor and committee members.

*Electives*—These courses add additional breadth and depth to the program. Students may add to their concentration coursework, select diverse offerings to complement concentration, or develop an additional area of focus.

*Degree Plan and Comprehensive Exam*—Students are assigned an advisor upon entering the program. A program evaluation is conducted and a dissertation advisor and dissertation committee are selected at the end of the first full year of study. A curriculum plan for the remainder of the program is developed at that time. Comprehensive and oral examinations are administered following completion of the second full year. Dissertation credit cannot be taken until comprehensive exams are scheduled.

*Dissertation Research*—Students develop a dissertation in their area of concentration. A minimum of 24 hours in dissertation research is required.

## HISTORIC PRESERVATION

### Master of Science

#### Certificate

The Master of Science in Historic Preservation degree is a professional degree program designed for students who will specialize in working with historic buildings, landscapes, and the decorative arts.

The program is based in Charleston in collaboration with the College of Charleston and is administered through Clemson's Department of Planning and Landscape Architecture. The program uses Charleston and the historic environs of South Carolina as a living laboratory. The size of the program is restricted to ensure focused research with the faculty. Coursework emphasizes studios, labs, and field seminars incorporating Charleston's rich community of preservation specialists as well as distinguished visiting faculty and researchers in the Graduate Center in Historic Preservation.

Students are admitted into the program from a variety of undergraduate disciplines relating to the built environment, with at least three semesters or equivalent of art/architectural/landscape history, as well as a strong background in broader historical studies. A portfolio with samples of work related to the built environment is encouraged, and students of the humanities and sciences are encouraged to apply.

#### Program Requirements

The 54-credit program is structured in sequential layers, beginning with an initial core semester devoted to the analysis and documentation of historic sites, followed by a more advanced studio-focused semester organized around the development of a preservation project. The second year focuses on advanced analysis and conservation studies, followed by a final semester of preservation administration done in conjunction with the student's thesis focus.

Thesis proposals are defended in the third semester of the program and completed as multi-media projects in the fourth semester of the program. Thesis projects are original research and incorporate each student's specific focus in the discipline of historic preservation. Projects using the historic resources of Charleston and its environs, or other suitable historic sites, are encouraged.

Professional internships are available through a variety of Charleston preservation initiatives, the national network of preservation specialists, as well as opportunities with national organizations such as the Historic American Building Survey and the National Trust for Historic Preservation.

#### Certificate in Historic Preservation

The Certificate in Historic Preservation is designed to enhance a variety of other degree programs at Clemson through advanced studies in historic preservation. The graduate certificate uses the first semester curriculum of the graduate program in Historic Preservation, otherwise known as the "foundation" semester, as a stand-alone semester in Charleston. This Charleston-based semester focuses on documentation and analysis of the design and craftsmanship of the historic city and exploration of the philosophy of preservation on site.



The 12-credit semester meets NCPE-mandated curriculum requirements. Prerequisites and further course requirements are determined by the student's degree program of study.

## HISTORY

### Master of Arts

#### Admission Requirements

Students are admitted to the graduate program upon the recommendation of the department's graduate program coordinator or department chair. All applicants to the MA program in History must submit the following to the University Admissions Office:

1. A minimum score of 500 on the verbal section of the Graduate Record Examination (GRE) and a minimum score of 4 on the writing section. (GRE scores more than five years old relative to date of initial enrollment are not accepted.)
2. Final transcript(s) for the BA sent by the applicant's undergraduate school(s), showing a minimum grade-point ratio of 3.0 in history courses; and 2.5 in all courses during the last two undergraduate years.
3. Three letters of reference, preferably from undergraduate professors.
4. A sample term paper.
5. A personal statement addressing the applicant's background in history, intended areas of specialization, and reasons for applying.
6. A completed University application form.

Additionally, if the applicant has 1) a grade-point ratio less than 3.0 in the history major for the BA degree and/or 2) a BA degree, including the major and minor, in subject(s) other than history, he/she will be required to take a minimum of four upper-level undergraduate history courses at Clemson or at another accredited university or college and receive a grade of B or better in each course before admission to the program. The only exception to this course requirement shall be persons who demonstrate that, as a part of their BA degrees, they completed a minimum of four upper-level undergraduate history courses with a grade of B or better. Any exceptions to these regulations require the consent of the department's Graduate Committee.

#### Application Deadline

Applications for fall semester must be postmarked no later than the previous April 15, and for spring semester no later than the previous November 1. Please note that consideration for assistantships takes place in January and February.

#### Requirements for Awarding of a Degree

The MA in History requires 30 credit hours in courses numbered 600 or above divided as follows:

1. HIST 881
2. HIST 820 or 872
3. A minimum of nine additional credit hours in courses numbered between 800 and 894, excluding HIST 885 and 891
4. A minimum of nine elective credits in graduate courses selected with the approval of the director of the graduate program

5. A minimum of six credits in HIST 891 (Master's Thesis Research), three of which should be taken in the second semester if enrolled full-time or within the first 18 credits in the program. Additionally, the student must write a thesis acceptable to the department and must demonstrate reading knowledge of a foreign language. A final examination, which may be written, oral, or a combination of the two forms, is required of all candidates.

Students holding an assistantship in the Department of History who receive a grade lower than B in any graduate course may have their assistantships terminated.

## LANDSCAPE ARCHITECTURE

### Master of Landscape Architecture

The landscape architecture profession is broad and interdisciplinary. Practicing landscape architects work on a wide range of project types including but not limited to urban and community design, historic preservation, ecological restoration, parks and park systems, institutional landscapes, memorials, cemeteries, industrial site reclamations, golf courses, wilderness areas and trails, residential landscapes and gardens.

The profession is both an art and a science. Successful landscape architects are creative professionals who hold an environmental imperative and a social conscience. They are also excellent facilitators, able to bring numerous disciplines and professions together to work on complex projects in the landscape.

Like other universities in the United States, Clemson offers two Master of Landscape Architecture (MLA) tracks—a first professional degree and a second professional degree. Both tracks offer students an opportunity for in-depth study in one of the department's focus areas—community and landscape change, health and design, and landscape restoration (including landscape ecology, history and historic preservation). A more general emphasis on international study supports the three focus areas. Research and study in those important topics of national and international consequence further ensure the marketability of Clemson's MLA graduates.

To qualify for admission to the first professional degree, students must hold a bachelor's degree in any discipline from an accredited college or university. Students come from a range of disciplines such as planning, history, English, biology, geology, geography, environmental science, various social or natural sciences, art, or other disciplines.

Students in the two-year second professional degree must hold a five-year Bachelor of Landscape Architecture (BLA) degree. Students with other accredited design degrees such as Bachelor of Architecture (BArch) and Bachelor of Science in Landscape Architecture (BSLA, generally a four-year degree) will move into the first professional program but will be allowed to complete the work in less than three years, depending on individual backgrounds and experiences. Admission to the program is based on GRE scores, three letters of recommendation, academic background and related transcripts, statement of

purpose, and work experience, if any. International students are expected to have exceptional TOEFL scores complementing the GRE.

### First Professional MLA

The three-year first professional degree is designed to provide students with a professional education and also an opportunity for research and/or in-depth project work. Because students hold bachelor's degrees from an array of backgrounds, it is necessary for them to gain landscape architectural skills. Those proficiency courses are also required for professional accreditation.

Students begin the program with a rigorous summer experience that provides an in-depth orientation into the profession and discipline. In the first years of the program, students focus on corequisite proficiency requirements but will also take a few important graduate-level courses. More graduate-level work, project-oriented research connected to a team project, and/or thesis project are emphasized during the final year. Summer off-campus experiences are optional. Students take 45 credits of corequisite proficiency coursework, 48 credits of 800-level courses, and six credits of 600-level courses, for a total of 99 credits.

### Second Professional MLA

The second professional degree in Landscape Architecture is a two-year program limited to students who hold an accredited five-year professional BLA degree. Second professional degree students take a total of 51 credit hours to earn the degree. Requirements include two 800-level seminars, one 800-level colloquium, and three 6-credit 800-level studios. In the final semester students choose between a six-credit 800-level collaborative studio or six thesis credits. Students are also required to complete a three-credit "Key Issues in Landscape Architecture" course. An external research methods course is required as are 12 elective credits (at least six credits must be at the 800 level). Summer off-campus experiences are optional. Like first professional degree students, second professional degree students may choose to engage in sophisticated team studio projects or complete individual thesis projects in the final semester.

## PROFESSIONAL COMMUNICATION

### Master of Arts

#### Certificate

The Department of English offers an interdisciplinary Master of Arts degree in Professional Communication. The program combines work in theory and research with a comprehensive emphasis on written, oral, and visual communication. It prepares graduate students to be professional and technical communicators in industry and government and to be teachers of professional communication in two-year colleges. In addition, the program provides the background necessary for students who plan to pursue a PhD in rhetoric or technical communication.

This degree is designed for students with strong writing skills from all academic disciplines. The program accommodates students with undergraduate majors in technical and scientific fields, as well as those with humanities and business degrees.



The Multimedia Authoring Teaching and Research Facility and the Class of 1941 Studio for Student Communication give MAPC students access to the newest computing hardware and software, enabling multimedia and Web design and production, digital video and audio editing, desktop publishing, and graphic design. The Campbell Chair in Technical Communication, the Pearce Center for Professional Communication, and the Effective Technical Communication Program in Engineering constitute a network of professors enabling students to work in professional communication in a variety of academic disciplines. The program also uses Clemson's expertise in agriculture and natural resources, architecture, city and regional planning, engineering, textiles, and basic science and technologies. The Usability Testing Facility allows students to conduct state-of-the-art usability research on interface designs, on-line documentation, and other publications. MAPC students wishing to pursue careers in the growing field of health communication also have the option of combining the Masters degree with the Health Communication Certificate program described below.

Additional information about faculty and services of the MAPC program is available on the Web at [www.clemson.edu/caah/mapc/](http://www.clemson.edu/caah/mapc/).

#### Admission Requirements

Applicants must hold a degree in any field from an accredited college or university, with a 3.0 grade-point ratio on a 4.0 scale; submit a satisfactory score on the GRE general test; submit at least two letters of recommendation from individuals familiar with the candidate's academic work and/or work experience; and submit a brief résumé and an autobiographical essay of not more than 500 words discussing educational goals and demonstrating proficiency for a writing program.

#### Requirements for Awarding of a Degree

The MA in Professional Communication requires 30 credit hours beyond the BA or BS degree, distributed as follows:

1. Five core courses which include ENGL 850, 851, 852, 853; and ENGL 856 or COMM 664.
2. Two or three electives from a list of recommended courses, structuring the program to meet professional goals. Possible electives include, but are not limited to, ENGL (COMM) 692, 695, 834, 836, 838, 839, 854, and 860.
3. Two cognate courses in a related discipline to tailor the degree to meet specific career goals. Possible cognate courses include, but are not limited to, ART 690, HRD (CTE) 847, MKT 631, and PSYCH 835. See *Careers* at [www.clemson.edu/caah/mapc/](http://www.clemson.edu/caah/mapc/).
4. Candidates must demonstrate a reading knowledge of a foreign language and pass a qualifying examination on a reading list before undertaking the required thesis or project.
5. Students choose either to write a thesis based on research and a thorough analysis of a problem in professional communication or to complete a project by solving a communications problem for a client in the professional world and by preparing a portfolio record of the project's progress.

## Health Communication Certificate

An interdisciplinary Certificate in Health Communication is also available to students in the MAPC degree program; to practicing health professionals who already have graduate degrees or are pursuing graduate degrees in Nursing, Health Sciences, and many other fields; and to students who are applying to or are already in the MAPC program. This 18-credit-hour certificate program offers students the ability to develop careers in writing for the pharmaceutical, scientific, medical, and/or health industries. It especially targets jobs in hospital systems, HMOs, clinics, CDC, and other local, national, and international health organizations. The certificate program is available through two tracks:

1. MAPC students who specialize in this field by taking ENGL (COMM) 804, 806, and (COMM) 807 to fulfill their MAPC program cognate requirements
2. Health professionals who need to update their communication skills to better meet the challenges of today's highly technological health settings

Unlike other programs in health communication, this program is geared toward the technological skills more applicable to today's health industry. In addition, the program can be customized to individual student needs, whether they be centered on technological skills available through the MAPC/HCC program or centered for those who already have technical skills in health content and/or medical humanities. This program is interdisciplinary and includes both arts and sciences approaches to health messaging. Additional information is available on the Web at [www.clemson.edu/caah/healthcomm/](http://www.clemson.edu/caah/healthcomm/).

## REAL ESTATE DEVELOPMENT

### Master of Real Estate Development

The full-time, 54-credit, two-year professional Master of Real Estate Development (MRED) degree program is jointly offered by the Department of Planning and Landscape Architecture in the College of Architecture, Arts, and Humanities and the Department of Finance in the College of Business and Behavioral Science. Required courses are drawn from six disciplines: MBA, finance, law, architecture, construction science and management, and planning and landscape architecture.

A two-week South Carolina Coastal Real Estate Development Field Tour is required during Maymester. Students study developments in Myrtle Beach, Pawleys Island, Charleston, Beaufort, and Hilton Head prior to the required ten-week supervised professional summer internship. Other regional field trips occur in Charlotte, Atlanta, and nearby areas.

The program creates the educational opportunity for future development entrepreneurs to produce exciting, quality projects respecting environmental and economic sustainability, social consciousness, design excellence, and financial feasibility within the risk-reward framework. The development industry is complex and requires leaders trained from diverse disciplinary perspectives. The program primarily follows the principles of the Urban Land Institute (ULI), which acknowledges that development is a public-

private partnership and that quality development requires integrating the perspectives of community, environment, and economics.

Many first-year students will obtain graduate assistantships for ten hours per week, assisting professors in research at the Center for Real Estate Development. Second-year MRED students (some first-year students with experience) may work two days each week during the academic year at paid internships with local real estate entities. Positions typically require interns to have transportation throughout the metro area (up to a 60-mile radius). The program requires a 10-week summer internship with a real estate business anywhere in the world. The program is establishing relationships with local chapters of real estate organizations to pursue scholarship opportunities.

The program seeks an interdisciplinary student body, which is entrepreneurial yet team-oriented. No specific bachelor's degree is required. Work experience is not required, although it is preferred.

The program focuses on the "master builder" concept, the methodology promoting an entire vision for a community through sustainable design, creative financing, place-making, and healthy communities. A graduate will become a visionary who serves as a craftsperson and designer of neighborhoods and community development, one who recognizes the role of the developer in guiding the different aspects of creating the built environment—political, economic, physical, environmental, legal, and sociological parameters.

Additional information is available by e-mail from [CURealEstate-L@clemson.edu](mailto:CURealEstate-L@clemson.edu) or on the Web at [www.clemson.edu/caah/pla](http://www.clemson.edu/caah/pla).

### Course Requirements

The Master of Real Estate Development Program requires a minimum of 54 credit hours (60 credits for students with no previous degree background and previous coursework in the field). Additional electives are based on class exemptions dependent on prior coursework.

Following is the required curriculum for students with no undergraduate background in the field:

#### First Year

##### First Semester

- 3 - C R P 602 Human Settlement
- 3 - C R P 802 Site Planning and Infrastructure
- 3 - M B A 819 Intro. to Accounting and Finance  
(for non-business degree majors)
- 3 - M B A (FIN) 836 Real Estate Principles
- 3 - RED 800 Real Estate Development Process

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##### Second Semester

- 3 - ARCH 820 Building Design and Construction Principles
- 1 - C R P 830 Introduction to GIS
- 3 - FIN 615 Real Estate Investment
- 3 - FIN 616 Real Estate Valuation
- 3 - RED 801 Real Estate Market Analysis
- 1 - RED 810 Real Estate Seminar Roundtable

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## Maymester and Summer Session

- 3 - RED 802 Real Estate Dev. Field Tour Seminar
  - 3 - RED 811 Summer Internship in Real Estate Development
- 6

## Second Year

### First Semester

- 3 - C S M 866 Contractor Role in Development
  - 3 - FIN 617 Real Estate Finance
  - 3 - LAW 848 Law for Real Estate Professionals
  - 3 - RED 803 Public-Private Partnership Dev.
  - 1 - RED 810 Real Estate Seminar Roundtable
- 13

### Second Semester

- 3 - C S M 862 Personnel Management and Negotiations
  - 3 - RED 804 Practicum in Master Planned/Resort Communities
  - 3 - RED 805 Practicum in Commercial Dev.
  - 3 - Elective
- 12

## RHETORICS, COMMUNICATION, AND INFORMATION DESIGN

### Doctor of Philosophy

The PhD program in Rhetorics, Communication, and Information Design features an interdisciplinary curriculum developed by faculty from Art, Communication Studies, and English. The curriculum provides a solid foundation in theory in addition to extensive training in research and practice.

Candidates for the PhD degree must complete 36 hours of graduate credit, including five required core courses (A A H 864, COMM 861, 862, ENGL 863, 865), five cognate courses in a specialization, and six credit hours of studio research or applied project work (ENGL 880). Candidates must also pass a comprehensive exam and write a dissertation.

#### Admission Requirements

Students admitted to the PhD program in Rhetorics, Communication, and Information Design must meet the following minimum requirements:

1. Minimum combined score of 1000 on the two objective sections (verbal and quantitative) of the Graduate Record Examination (GRE) and a minimum score of 4 on the analytical writing section. (GRE scores more than five years old relative to the date of initial enrollment will not be accepted.) Because of the strong communication component of the PhD program, non-native speakers of English must have a minimum TOEFL score of 550 (paper version) or 213 (computer version) in addition to the GRE scores.
2. Master's degree in Communication Studies, English, Art, Professional Communication, or other related field. A student with a master's degree in another field of study may apply to the program with the understanding that he/she may be required to complete prerequisite, master's-level courses in professional communication prior to full admission to the PhD program.

3. Minimum grade-point ratio of 3.5 in previous graduate work. The student must submit all transcripts of previous graduate and undergraduate work.
4. International students seeking graduate teaching assistantships, whose native language is not English and whose secondary education (and beyond) was not taught fully in English, must pass the SPEAK test of proficiency in spoken English. Specialists in English as a Second Language administer this test at Clemson University. Prospective international teaching assistants will also undergo an interview during which their proficiency in spoken English will be evaluated by faculty members in the RCID program.

In addition, the student must submit the following:

- Portfolio of previous graduate work, including a writing sample, preferably a sole-authored paper submitted in a graduate class
- Personal statement addressing the student's interest and intent in pursuing the PhD in Rhetorics, Communication, and Information Design
- Minimum of three letters of reference from academic sources
- Completed admission form to Clemson University

## VISUAL ARTS

### Master of Fine Arts

The Master of Fine Arts degree is the terminal degree in the visual arts. Clemson University's program offers concentrations in the studio areas of drawing, painting, printmaking, ceramics, photography, and sculpture. Interdisciplinary and collaborative projects are encouraged within the department. The primary goal of the program is to provide students opportunities to develop a high degree of professional competence in their chosen area of concentration.

#### Admission Requirements

The Master of Fine Arts degree program in Visual Arts admits a limited number of talented and creative candidates on a competitive basis upon review of the following materials:

1. Bachelor's degree from an accredited college or university with a major in Visual Arts. Especially well-qualified persons from other disciplines or degree backgrounds with exceptionally strong portfolios may be accepted.
2. Minimum grade-point ratio of 3.0 on the last 60 major credit hours of undergraduate work
3. Portfolio documentation of the applicant's creative work. The portfolio should include 15–20 works, the majority of which represent the applicant's chosen field of study and should consist of 20 slides with an accompanying listing of the slides identifying size of work and media used. Supplemental materials such as photographs or digital prints of the artwork may also be included. The portfolio is reviewed by the Admissions Committee, composed of members of the faculty of the Department of Art. Applicants are also encouraged to arrange for a campus interview before or during the application process.
4. Three letters of recommendation from major professors, producing artists, or professional acquaintances who are familiar with the applicant's work and development in the visual arts

5. A one to two-page artist statement that provides insight into the development of the work completed to date. The statement should address ideas relative to form and content.

6. Statement of intent regarding applicant's interest in pursuing the graduate degree

7. No GRE is required.

#### Requirements for Degree Candidacy

The prospective candidate must have a review of his/her work at the end of each semester. It will be determined at this time if the student should continue or whether additional study is required at either the undergraduate or graduate level. Upon completion of 30 hours, the candidate must pass an oral review to determine readiness for thesis work. A Graduate Thesis Committee will be assigned at this time to assist the thesis development and concluding thesis exhibition.

The candidate must complete 30 hours and a full-time residency during the second year of study.

#### Requirements for Awarding of a Degree

1. A minimum of 45 credit hours with a B average or better in the student's professional curriculum, including 36 hours of ART 600- and 800-level studio courses and nine hours of A A H 600- and 800-level history of art and

2. A 15-credit-hour thesis culminating in satisfactory completion of a written documentary of the "thesis exhibition" and an oral examination by the graduate faculty



# COLLEGE OF BUSINESS AND BEHAVIORAL SCIENCE

The mission of the College of Business and Behavioral Science is to develop leaders who are exceptionally qualified, globally competitive, entrepreneurial, and committed to the betterment of society; produce scholarly research that is relevant to our stakeholders; and support professional and public service activities that contribute to economic, social, and intellectual development.

The College of Business and Behavioral Science offers advanced degrees in Accounting, Applied Economics, Applied Psychology, Applied Sociology, Business Administration, Economics, Electronic Commerce, Graphic Communications, Human Factors Psychology, Industrial/Organizational Psychology, Management, and Public Administration. The Master of Real Estate Development is offered in cooperation with the College of Architecture, Arts, and Humanities.

Courses are offered in finance, law, marketing, and political science to provide program requirements and electives for students in other areas.

The graduate programs in the College of Business and Behavioral Science provide a wide range of opportunities for academic careers and for professional careers in business, industry, government, and nongovernment public sector organizations. Degrees offered in the business disciplines are fully accredited by the Association to Advance Collegiate Schools of Business (AACSB).

In the MA, MS, and PhD programs, extensive research programs involve graduate students in both theoretical and applied research and provide excellent opportunities for thesis and dissertation research. The professional master's degree programs feature internships that provide opportunities for practical experience in the student's field. Financial aid, in the form of fellowships and teaching and research assistantships, is available for full-time participants in all graduate programs.

In addition to a full range of graduate programs offered on the main Clemson campus, some degree programs may be completed via off-campus evening programs. The Master of Business Administration (MBA) and the Master of Public Administration degrees are offered at the University Center of Greenville and at Lander University in Greenwood.

Additional information is available on the Web at [business.clemson.edu](http://business.clemson.edu).

## ACCOUNTING

### Master of Professional Accountancy

The Master of Professional Accountancy (MPAcc) degree program prepares students for positions in industrial, commercial, governmental, financial, or public accounting. The program requires 33 credit hours and ACCT 899 and is open to students with appropriate backgrounds. The program accommodates full- and part-time students. Full-time students are able to complete the program in one year. The program recognizes the rapid pace of change in accounting resulting from technological advances in managing data, the theory and practice of management, and increases in the volume and scope of authoritative pronouncements from the FASB, SEC, and IRS. Two specializations are available: Assurance and Management Services and Taxation. The program is accredited by AACSB, International.

Applicants should hold a bachelor's degree from an institution whose scholastic rating is acceptable to the Graduate Admissions Committee of the School of Accountancy and Legal Studies. Admission to the program is based on academic record and score on the Graduate Management Admission Test (GMAT). Letters of recommendation and relevant work experience also may be considered. Applicants should have completed a basic business core of at least 30 credit hours, as well as the following accounting prerequisites: intermediate accounting (at least six credit hours), cost accounting (three credit hours), tax (three credit hours), auditing (three credit hours), and accounting information systems (three credit hours). Current information is available on the Web at [www.business.clemson.edu/Account/index.html](http://www.business.clemson.edu/Account/index.html).

## APPLIED ECONOMICS

### Doctor of Philosophy

The graduate program in Applied Economics utilizes the facilities and faculty of the Department of Economics and the Department of Applied Economics and Statistics in the College of Agriculture, Forestry, and Life Sciences. Students may carry out their dissertation research under the direction of a faculty member from either department.

Applicants to the PhD program should have a strong background in economic theory and statistics. The program has required fields in these areas. Students choose two additional concentrations from financial economics, labor economics, monetary economics, environmental economics, industrial organization, public sector economics, and other fields supported by departments across the University.

## APPLIED SOCIOLOGY

### Master of Science

The Department of Sociology offers the MS degree in Applied Sociology emphasizing practical and theoretical knowledge in the areas of industrial and organizational sociology and focusing on the acquisition of social research skills, theory application, and practical field experience. Students are prepared for employment in federal, state, and local government agencies; in industry and related agencies; and to pursue a doctorate.

Applicants must hold a bachelor's degree from an accredited degree program; must have completed a minimum of 15 undergraduate credit hours in sociology or another social science discipline that includes at least one course each in statistics, research methods, and sociological theory; must submit GRE scores on the verbal, quantitative, and written sections (satisfactory scores normally include a minimum of 500 on the verbal and quantitative sections of the test and a 4.0 on the written section); must submit three letters of recommendation, at least two of which are from faculty members of the applicant's previously attended college or university; and must submit a 500-word essay on career aspirations and goals, explaining how completion of this program in Applied Sociology will assist in achieving these goals.

Students selecting the thesis option are required to complete a minimum of 34 credit hours of coursework including SOC 803, 805, 807, 810, 830, 895, and either ANTH 603 or SOC (R S) 671. In addition, students choosing the thesis option are required to complete six hours of thesis credit (SOC 891) and successfully defend a formal thesis. Students choosing the nonthesis option must complete 40 hours of coursework including SOC 803, 805, 807, 810, 830, 895 and either ANTH 603 or SOC (R S) 671. In addition, students selecting the nonthesis option must pass a departmentally administered comprehensive examination. Students must demonstrate competence in basic statistics by either passing a departmentally administered competency examination or by earning a B in EX ST 801. A six-hour internship in an applied setting is required of all students. The field placement is coordinated by the student, the graduate director, and the on-site supervisor. Typically, the internship is completed in the summer between the first and second years of the program, but only after completing a minimum of 12 credit hours of 800-level coursework. In exceptional circumstances, the graduate coordinator may approve the substitution of six hours of appropriate coursework for the field placement when the student has had work experience comparable to the placement.

## BUSINESS ADMINISTRATION

### Master of Business Administration

The Master of Business Administration programs, full-time and part-time, provide advanced business education to prepare graduates for successful careers in a global market. MBA students come from a wide variety of business and nonbusiness backgrounds. Additional information is available on the Web at [business.clemson.edu/mba](http://business.clemson.edu/mba) or by e-mailing the MBA Office at [MBA@clemson.edu](mailto:MBA@clemson.edu).

The two-year, 62- to 64-credit-hour, full-time MBA program is held on the Clemson campus. This intensive program starts in the fall only and allows students the flexibility to tailor the degree to meet specific career goals. The first year (34 credit hours) provides a strong foundation in graduate-level core business areas including economics, statistics, marketing, management, business law, finance, operations, information systems, and accounting. MBA seminars include top industry speakers and career-enhancing workshops. In the second year (28–30 credit hours),



students take four specialization courses specific to their professional goals, three tools courses, a strategic management class, and two electives. During the summer, students participate in internships, study abroad, or take classes at Clemson.

The part-time, evening MBA (33–44 credit hours) is offered at the University Center of Greenville in a live classroom setting. Each class meets one night a week. The program includes five foundation courses (11 credit hours), which provide basic business knowledge, and 11 advanced business courses (33 credit hours), including three electives. Typically, it takes two to three years to complete the program.

A college-level calculus class is the only prerequisite for both programs. Admission is based on GMAT (Graduate Management Admission Test) scores, two letters of recommendation, academic background (transcripts), statement of purpose (full-time program only), and work experience (résumé required). A minimum of two years of work experience beyond the bachelor's degree is required for the part-time program. One year of work experience is preferred, although not required, for the full-time program. A separate fee structure applies to evening program classes.

## ECONOMICS

### Master of Arts

Applicants to the MA degree program must have completed at least 12 credit hours of undergraduate economics, including a course in intermediate price theory. A background in mathematics, including at least one course each in calculus and statistics, is also required. When necessary, the economic theory, mathematics, and statistics courses may be taken at Clemson University.

The graduate program includes at least one course in econometrics and a minimum of two courses in economic theory. Program concentrations in financial economics, labor economics, monetary economics, environmental economics, industrial organization, and public sector economics have been designed for students interested in these areas.

Students pursuing a terminal MA degree must complete 24 credit hours of coursework and submit an approved thesis. Students continuing beyond the first year may receive an MA degree upon the completion of the PhD core courses with at least a B average. With the permission of the graduate coordinator, a maximum of six hours of course credit may be earned for graduate courses taken at Clemson outside the Department of Economics. All remaining courses must be taken within the department.

### Combined Bachelor's/Master's Plan

The Department of Economics allows students to count up to 12 hours of graduate credit (800-level courses) toward both the bachelor's and master's degrees. Students participating in this program must have a minimum cumulative grade-point ratio of 3.4 and be admitted to the Graduate School prior to registering for graduate courses. Details of the suggested curriculum and program information are available from the Department of Economics. Application details are available in the *Academic Regulations* section of this catalog.

## ELECTRONIC COMMERCE

### Master of Electronic Commerce

The College of Business and Behavioral Science and the Department of Computer Science in the College of Engineering and Science jointly offer and administer this program. The MEC is a professional degree program to prepare students for management careers in electronic business and on-line supply chain operations and also as managers of information systems professionals.

This interdisciplinary program features required courses in management, computer science, and marketing. Students may also specialize in either business-to-business (B2B) or business-to-consumer (B2C) systems. Each student completes an e-commerce project in his/her last semester of the program.

The following courses (18 credit hours) are required: CP SC 662, M B A 876, MGT 818, 829, 830, 833.

Twelve credit hours of electives are required and may be selected from CR P 634, CP SC 663, 851, M B A (FIN) 807, 862, 871, MGT 812, (M B A) 861.

Only one of the following three courses may be taken as an elective: I E 802, PSYCH 835, 899.

Only one of the following courses may be taken as an elective: SOC 803, 805, 830.

## GRAPHIC COMMUNICATIONS

### Master of Science

The Master of Science in Graphic Communications degree program prepares students for technical, creative, or professional careers in graphic communications, the third largest manufacturing industry in the United States. The program serves the needs of graphic communications, graphic arts, printing management, or graphic design graduates from other institutions, as well as undergraduates with degrees in engineering, manufacturing, computer science, communications, technology, and various business fields who want to transition into graphic communications fields.

The MS program is enhanced by Clemson's undergraduate program of more than 400 students and works closely with Clemson's nationally recognized Packaging Science program. Industry supports well-equipped G C laboratories. Graduates are placed in positions in a variety of printing, packaging, publishing, imaging, and related industries in management, marketing, sales, customer service, creative, technical, scientific, and academic positions. Placement rates are consistently high.

Program entrance is available fall, spring, and first or second summer terms. Requirements for the program include 33 credit hours of graduate courses for a nonthesis option or 30 hours with a thesis. Within the total requirements, at least 17 hours will be in G C technical/managerial courses; seven will be research related; six credits will be from outside the Graphic Communications Department; and at least one-half will be at or above the 800 level. Based upon applicant's undergraduate course work and work experience, prerequisite courses may

be required in specific areas. Students without relevant work experience will also complete an industrial internship.

In addition to the standard Application for Admission, the Graphic Communications Department admissions committee requests a narrative of approximately two pages in length, to include related and nonrelated work history, educational background, current position and an explanation of how Clemson's MS in Graphic Communications program relates to the applicant's professional goals. A separate résumé should accompany the narrative.

## MANAGEMENT

### Master of Science

#### Doctor of Philosophy

The Master of Science in Management program prepares students for leadership positions in industry by focusing on the management of operations. The program also prepares students for further advanced study in management. Students come from a variety of academic backgrounds including business, engineering, physical sciences, mathematics, and computer science. The program builds on the educational background of undergraduate business majors by providing an important focus toward operations, the part of the organization where most assets and people are employed. For individuals with a technical undergraduate degree, the program complements their mathematics, engineering, and basic sciences coursework by developing an integrated view of operations management.

The MS in Management program focuses on the capabilities and resources of operations and its role in the formulation and implementation of organization strategies for both manufacturing and service industries in a global economy. The program addresses critical material and information flows in organizations, providing a knowledge base and skill set for solving problems in operations management. Ten courses and a final examination are required. Basic courses in finance, accounting, economics, and marketing may be required as corequisites for some students. Most full-time students should be able to complete the program in three semesters.

The PhD program in Management provides advanced education for students of outstanding ability who are pursuing careers in university research and teaching, business, or government. The program currently offers focus tracks in two areas—operations management and information systems.

The Operations Management track is a balanced program of management theory, analytical techniques, and research methodology focusing on the management of operations. The OM track is designed to provide a broad conceptual view of operations, expert knowledge of processes for operations management, understanding of analytical and empirical research methodologies, and appreciation for issues in teaching operations.

The Information Systems track offers a balanced program of concepts, theory, and methods by providing a foundation in IS technologies, development, and business impact. In addition, topics relating to the use of such systems to promote orga-



nizational effectiveness and strategic advantage and as enablers of business process change and electronic business are covered.

Formal coursework leading to the dissertation stage of the PhD program is divided into the scholarly methods courses, foundation courses, and advanced courses, in addition to at least 18 credit hours of doctoral dissertation research. Depending on the student's background and research interests, he/she may be required to take additional courses.

## MBA

See Business Administration on page 55.

## PSYCHOLOGY

The Department of Psychology offers PhD degrees in Industrial/Organizational Psychology and in Human Factors (Engineering) Psychology and an MS degree in Applied Psychology with concentrations in Industrial/Organizational Psychology and Human Factors Psychology. These programs are designed to provide the student with the requisite theoretical foundations, skills in quantitative techniques and research design, and practical problem-solving skills to address human problems related to work. The Department of Psychology is a member of the Council on Applied Master's Programs in Psychology. The Human Factors Concentration is fully accredited by the Human Factors and Ergonomics Society.

## APPLIED PSYCHOLOGY

Master of Science

## HUMAN FACTORS PSYCHOLOGY

Doctor of Philosophy

## INDUSTRIAL/ ORGANIZATIONAL PSYCHOLOGY

Doctor of Philosophy

A formal thesis and supervised field internship are required for the MS degree. MS students complete 45 credit hours, including six hours of thesis credit and six hours of credit for the internship. Typically, the internship is completed in the summer between the first and second years of the program. In some cases, six credit hours of approved electives may be substituted for the field internship.

Students in the doctoral programs are expected to satisfy the master's program requirements plus an additional 45 credit hours prior to receiving the doctorate. In addition to the required courses, a doctoral program must include 18 hours of dissertation research and an oral dissertation defense. Students are admitted to candidacy for the PhD degree upon successful completion of a qualifying examination.

Applicants to these programs should have an undergraduate degree with a major in psychology or a related field from an accredited college or university. Students with a major other than psychology should have a minimum of 15 semester hours be-

yond the introductory psychology survey course. Applicants to the master's program in Human Factors Psychology must also have at least one undergraduate course in calculus. All applicants must submit scores from the general portion of the GRE. Applicants must also submit three letters of reference, a personal interest statement, and a résumé. The application deadline is January 31. For more information about these programs or additional application requirements, visit the Psychology Department's Web site at [www.clemson.edu/psych/](http://www.clemson.edu/psych/).

## PUBLIC ADMINISTRATION

### Master of Public Administration

The Department of Political Science participates with the Department of Political Science at the University of South Carolina in offering the joint professional degree Master of Public Administration. Courses for this program are taught only at the University Center of Greenville.

The MPA degree program requires 39–45 credit hours, depending on the student's background. Students lacking proficiency in American government are required to address the deficiency by taking a prerequisite in this area. Students who do not have substantial administrative experience are required to complete an internship encompassing 480 hours in a public or nonprofit agency engaged in administrative work. All MPA students must complete seven core courses (PO SC 702, 821, 822, 827, 829, 841, 862), one level of government course (PO SC 860, 867, or 868), and five electives. Finally, all students must demonstrate a proficient knowledge of the field of public administration by passing a comprehensive examination. Students may request to take the PO SC 880 in lieu of the comprehensive examination.

### Certificate in Public Management

#### Admission Requirements

Admission will be based on an assessment of the applicant's educational needs and career objectives. Applicants must hold a bachelor's degree and should have earned an overall 3.0 grade-point ratio in all undergraduate studies. Each applicant must also furnish a letter of recommendation, an application (available from the MPA program office), transcripts, statement of career objectives, and a résumé.

Students from any department or discipline may elect to complete the certificate program. Students who are already enrolled in a graduate degree program must obtain written approval from their graduate programs/advisors and the MPA Director. No prerequisites are required of these students.

In addition to the conditions above, international applicants are required to demonstrate that they satisfy the University's minimum English language proficiency requirements or equivalent.

Students currently pursuing MPA coursework in a non-degree status may apply for the Graduate Certificate in Public Management. The hours earned in a non-degree status may be applied to the certificate program requirements (within four years of completion of the courses.)

### Course Requirements

Courses are determined by the student's educational needs and career objectives and must be reviewed and approved by the MPA director. Other graduate courses may be substituted in the elective sequence with the approval of the MPA director. Program participants must maintain an overall minimum grade-point ratio of 3.0 in the certificate program. Certificate courses must be completed within a span of four years.

A graduate certificate will be awarded upon completion of 12 credit hours of study, as outlined below, and submission of a *Certificate Portfolio* which will consist of a compilation of the cumulative coursework accomplished in the program.

The following coursework is required:

*Core Sequence*—one course selected from PO SC 821, 822, 827, 829, 862

*Elective Sequence*—three courses selected from PO SC 867, 868, 877, 878 (topics differ by section)

Credit earned for a certificate may be applied toward the Master of Public Administration degree with the advice and approval of the MPA Director.

## REAL ESTATE DEVELOPMENT

### Master of Real Estate Development

The Master of Real Estate Development Program, jointly administered by the Department of Finance and the Department of Planning and Landscape Architecture in the College of Architecture, Arts, and Humanities, creates the educational opportunity for encouraging future development entrepreneurs to produce exciting, quality projects respecting environmental sustainability, social consciousness, design excellence, and financial feasibility within the risk-reward framework. See page 53 for the complete program.

## TECHNOLOGY ENTREPRENEURSHIP

### Certificate

The Certificate in Technology Entrepreneurship is available to graduate students in engineering and science disciplines across campus. The certificate is intended to serve those students who envision an entrepreneurial career as their long-range career goal, who want to be involved in new product and new business activities within a corporate setting, or who seek a better understanding of the process of commercializing inventions.

The program requires E L E 600, 800, and one of the following: an additional section of E L E 800, M B A (MGT) 845, or M B A 875.



## COLLEGE OF ENGINEERING AND SCIENCE

The College of Engineering and Science offers advanced degrees in Bioengineering; Biosystems Engineering; Chemical Engineering; Chemistry; Civil Engineering; Computer Engineering; Computer Science; Digital Production Arts; Electrical Engineering; Electronic Commerce; Environmental Engineering and Science; Environmental Toxicology; Hydrogeology; Industrial Engineering; Materials Science and Engineering; Mathematical Sciences; Mechanical Engineering; Physics; and Textiles, Fiber and Polymer Science.

Courses are offered in astronomy, engineering graphics, and environmental science and policy to provide electives for students in other areas.

Degrees offered are the Master of Engineering, Master of Science, and Doctor of Philosophy.

The MS and PhD programs serve primarily full-time graduate students. Industrial Residency programs leading to the Master of Science degree are available in certain engineering departments. Financial aid, in the form of full and partial fellowships and teaching and research assistantships, is available. Other financial aid packages are available to outstanding applicants. A broad and vigorous research program provides excellent thesis and dissertation research opportunities.

The Master of Engineering program is open to individuals who are interested in professionally oriented advanced study. Requirements for the program are a baccalaureate degree from an ABET-accredited engineering program or equivalent, academic and professional records which indicate motivation for and the ability to complete additional professional study, and acceptance by the chair of the department in which the individual plans to major and by the Dean of the College of Engineering and Science.

Graduate Engineering Education opportunities for practicing engineers are available in two disciplines. The Department of Electrical and Computer Engineering offers off-campus graduate courses leading to the Master of Science or Master of Engineering degree through satellite broadcasts. The Department of Mechanical Engineering offers selected off-campus graduate courses at the University Center of Greenville. Furthermore, graduate courses in both disciplines are offered on-campus during the late afternoon/early evening once a week.

## BIOENGINEERING

### Master of Science

### Doctor of Philosophy

Bioengineering is the application of engineering and scientific principles to understand and solve medical problems. As medical technology has rapidly developed over the past four decades, the demand for qualified bioengineers has dramatically increased. Career opportunities for bioengineers range from teaching and conducting basic research in academia to research and development work in the growing medical product industry. Employment opportunities are also available in independent research laboratories, hospitals, and federal agencies such as the Food and Drug Administration or the National Institutes of Health.

Clemson University's Bioengineering Program is one of the oldest in the world; its PhD program began in 1963, and its MS program was added in 1966. Historically the department is widely recognized to have pioneered the field of biomaterials. Today the Department of Bioengineering at Clemson maintains its focus on biomaterials and related areas, including tissue engineering, regenerative medicine, drug delivery, biomechanics, and biosensing. The department takes pride in the fact that it remains one of the few graduate-only bioengineering programs in the country, which enables it to remain centered on graduate education and research. Although Clemson University does not have a medical school, the Bioengineering Department maintains close collaborative ties with several medical centers in the Carolinas. In particular, Clemson has a formal partnership with the Medical University of South Carolina, located in Charleston, and maintains full-time bioengineering faculty and students at both campuses. Interactions between the two institutions are facilitated by state-of-the-art video-conferencing facilities, which enable students to take classes and directly interact with faculty at either location. A joint MD/PhD program is provided for qualified students as part of this partnership.

Applicants to the Department of Bioengineering typically hold a Bachelor of Science degree in engineering, science, or life science. Students with non-engineering backgrounds may be required to take remedial courses in engineering (e.g. materials science, statics and mechanics, and calculus through differential equations) in addition to their regular bioengineering curriculum, which may be taken either before or after enrollment.

The Department offers two graduate degrees: the Master of Science and the Doctor of Philosophy. The curriculum for the MS degree consists of a core of recommended bioengineering courses supplemented by elective courses that provide the student greater depth in his/her specific area of interest. Two degree options are offered at the master's degree level: a thesis and a nonthesis option. The thesis option requires a total of 30 credit hours (six of which must be research credits) and the submission and defense of a master's thesis. The nonthesis option requires a minimum of 33 credit hours (six of which must be research credits) followed by the submission and oral presentation of a publishable-quality report on an approved topic. The minimum time

period necessary to complete the master's degree is normally 16 months, out of which at least one academic semester must be undertaken in residence as a full-time student at Clemson University.

Students interested in obtaining a doctoral degree are encouraged to apply directly to the PhD program from their BS degree program, with the PhD program typically requiring about five years to complete following the BS degree or about four years following the MS degree. The selection of courses for the doctoral degree is flexible and depends on the background and objectives of each candidate. A typical program includes 18 or more credit hours of graduate-level courses beyond the MS degree requirements. Candidates for the PhD degree must provide evidence of their potential success in advanced graduate study. This is demonstrated by passing both the qualifying and comprehensive examinations, which are usually taken after the first year of graduate school. The qualifying examination consists of both written and oral exams that cover the basics of bioengineering with an emphasis on the student's area of concentration. The comprehensive examination involves the oral presentation and defense of the student's proposed original research plan before his/her selected research committee and is typically taken within a year of passing the qualification exam. The PhD program culminates with the presentation and successful defense of a doctoral dissertation, which is scheduled following the completion of the student's approved research plan.

### Combined Bachelor of Science in Biological Sciences/Master of Science in Bioengineering

Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements.

Students are encouraged to obtain the specific requirements for the dual degree from the Department of Biological Sciences or Bioengineering as early as possible in their undergraduate program, as a number of required courses have prerequisites not normally taken by Biological Sciences majors.

Enrollment guidelines and procedures can be found under *Academic Regulations* in this catalog.

## BIOSYSTEMS ENGINEERING

### Master of Science

### Doctor of Philosophy

This program is administered jointly with the College of Agriculture, Forestry, and Life Sciences. Graduate programs in Biosystems Engineering prepare individuals for leadership, creative accomplishment, continued professional learning, and independent research.

Students may be accepted with backgrounds in any branch of engineering or quantitative-based scientific fields relating to chemistry, mathematics, physics, or biology. Undergraduate prerequisite or corequisite courses may be required for applicants with undergraduate degrees in nonengineering disciplines.



Each degree program is planned individually to augment the student's previous engineering and science background with adequate breadth in engineering and specialization in an area of biosystems engineering. Coursework includes biosystems and related engineering, mathematics, physics, chemistry, statistics, and biological, environmental, and engineering sciences.

Candidates for the MS degree are required to complete a minimum of 24 hours of coursework plus an additional six hours of thesis research and complete an acceptable thesis.

Candidates for the PhD degree are required to complete additional hours of coursework beyond the MS degree at the discretion of the graduate committee. The number of these credit hours typically ranges from 30 to 36. Also required is the completion of 18 hours of dissertation research and the submission of an acceptable dissertation.

Acceptance is determined by departmental faculty review based on records of academic achievements (including grades from previous programs and GRE scores) and other appropriate professional accomplishments. Additional information is available on the Web at [www.clemson.edu/agbioeng/bio/](http://www.clemson.edu/agbioeng/bio/).

## CHEMICAL ENGINEERING

### Master of Science

#### Doctor of Philosophy

Students may be accepted with backgrounds in chemistry, physics, or branches of engineering other than chemical engineering. Special programs are available for nonchemical engineering graduates. MS degree candidates must complete a thesis.

The MS degree program consists of 30 credit hours of work including six credit hours of research. The coursework includes CH E 803, 804, and 805. In addition, six hours of approved chemical engineering electives and nine hours of approved technical electives are required. At least six of these 12 elective hours must be selected from courses numbered 800 or above.

The PhD program consists of 36 credit hours of approved graduate courses beyond the BS degree including 12 credit hours of approved graduate courses at Clemson. Doctoral students must satisfy the MS course requirements through courses taken at Clemson University or elsewhere. Each doctoral student must complete at least six credit hours of approved graduate courses offered by departments other than Chemical Engineering. In addition, each student is required to complete 30 credit hours of graduate research including 18 doctoral dissertation research credit hours (CH E 991) taken at Clemson University. These requirements establish minimum coursework and research credit requirements and usually are exceeded at the advice of the individual student's advisory committee.

Minors for doctoral students may be taken in chemistry, physics, mathematics, life sciences, or other branches of engineering.

## CHEMISTRY

### Master of Science

#### Doctor of Philosophy

Degree concentrations are offered in analytical, inorganic, organic, physical chemistry, and chemistry education. Research areas also include bioorganic chemistry, polymer chemistry, materials chemistry, chemical physics, and other areas. A PhD degree in Chemistry with a concentration in textile chemistry is offered jointly with the School of Materials Science and Engineering.

MS degree candidates must complete 24 hours of coursework and six hours of research culminating in a satisfactory thesis. PhD degree candidates who have not previously been awarded an MS degree in chemistry must complete a regimen of coursework that is at least equivalent to that which would be required to earn an MS degree.

The primary requirement for the PhD degree is the performance of original research leading to a dissertation. PhD degree candidates must qualify to pursue the degree by completing a core of four courses with at least a B average during the first two years of study. The core courses are taken in four areas: one in organic, one in physical, one in analytical, and one in inorganic chemistry. Qualification requirements may also be satisfied by examination.

Admission to candidacy for the PhD degree requires completion of either a cumulative or a comprehensive examination in the area of concentration. The examination, the type of which depends upon the area selected by the student, may be followed by an oral presentation before a faculty committee.

## CIVIL ENGINEERING

### Master of Science

#### Doctor of Philosophy

The Department of Civil Engineering offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. Within these degrees, there are six primary emphasis areas: Applied Fluid Mechanics, Construction Materials, Geotechnical Engineering, Project Management, Structural Engineering, and Transportation Systems.

#### Master of Science

The Master of Science degree program is open to all individuals who have a four-year baccalaureate degree. A degree in engineering is not required for admission, but most entering students have an undergraduate Civil Engineering degree.

There are two options available for students pursuing a Master of Science degree. The student may prepare a research thesis or may take additional courses in lieu of completing a thesis.

The thesis option requires the preparation of a research thesis that is a part of the total credit hours required for the degree. Students intending to pursue a doctoral degree will usually choose the thesis option. Completion of a research thesis is excellent preparation for the research necessary for a doctorate if a student is inclined to pursue that degree in the future.

The nonthesis option does not require the preparation of a research thesis but does require completion of additional coursework. This degree option provides the student with additional directed study through coursework. Normally students pursuing the nonthesis option will not pursue a doctorate.

Except for the core courses required by different disciplines, there are no formal course requirements for students pursuing a Master of Science degree. The graduate degree program normally contains some engineering design and a minimum of ten credit hours of engineering science, advanced mathematics, and basic science. In addition, each student in the thesis option must complete an advanced research project. All students pursuing a Master of Science degree must satisfactorily complete CE 895. The final program of study must contain at least 30 semester hours of graduate credit including the core curriculum requirements. Of the 30 hours, no more than six hours may be thesis research (CE 891) for those students pursuing the thesis option. At least half of the remaining hours must be from courses numbered 800 or above.

The final examination for the MS nonthesis option is an oral or written examination (or a combination of the two) consisting of questions related to fundamental knowledge in a student's chosen area of concentration (i.e. applied fluid mechanics, construction materials, geotechnical engineering, project management, structural engineering, or transportation systems).

The final examination for the MS thesis option is an oral examination consisting of a student's MS thesis defense and questions related to fundamental knowledge in a student's chosen area of concentration (i.e. applied fluid mechanics, construction materials, geotechnical engineering, project management, structural engineering, or transportation systems).

#### Doctor of Philosophy

The Doctor of Philosophy degree program is open to all individuals who have a baccalaureate degree and preferably a Master's degree in engineering. Except for the core courses required by different disciplines, there are no formal course requirements for students pursuing a PhD degree; however, each student must complete 18 hours of dissertation research (CE 991). All students must complete CE 895.

The purpose of the PhD research dissertation is to afford the student the opportunity to participate in independent specialized engineering research that can advance the state of the art. The research is conducted under the direction of a member of the faculty who will normally serve as chair of the student's academic advisory committee. The research should be sufficiently demanding technically so as to demonstrate the student's ability to assimilate knowledge from several subject areas for the advancement of engineering knowledge.

*Student Evaluation*—During the first two semesters in residence, a PhD student must select a faculty advisor. The faculty advisor may assign the student specific duties outside normal coursework requirements that include, but are not necessarily limited to, preparing research proposals and literature surveys, conducting classroom lectures, formulating



computer models, and executing data collection and analysis. The advisor may, at any time, withdraw as the student's faculty advisor if these assigned duties are not performed consistent with the expectations of the faculty advisor. During this initial two-semester period, an advisor should make a determination as to whether a student is capable of completing the requirements for the PhD degree.

**Comprehensive Examination**—The PhD comprehensive examination is generally scheduled after all coursework has been completed and the dissertation proposal is ready for approval by the student's graduate committee. The examination, therefore, consists of two parts: (1) a written and/or oral examination by the advisory committee on the student's preparation to complete the proposed research and (2) presentation of the proposed research. The PhD comprehensive examination should be completed within two years of entering the PhD program. The written and/or oral examination may include consideration of graduate coursework, preliminary research, and/or other demonstration of the ability to conduct the proposed research. After passing this examination, the student is officially admitted to candidacy for the PhD degree.

**Dissertation Defense**—As required by the Graduate School, the candidate for the Doctor of Philosophy degree must pass a final oral examination (dissertation defense). The examination consists of a presentation of the student's doctoral research and an assessment by the committee of the research approach, the significance of the findings, and the contribution to the advancement of civil engineering.

More information about the Department of Civil Engineering is available at [www.ce.clemson.edu](http://www.ce.clemson.edu) or by phone at (864) 656-3000.

### Combined Bachelor's/Master's Plan

Civil engineering undergraduates at Clemson University may begin a Master of Science (MS) degree program while completing the Bachelor of Science (BS) degree and use a limited number of courses to satisfy the requirements of both their undergraduate and graduate degrees. The following requirements apply:

1. Undergraduate students must have a minimum cumulative grade-point ratio of 3.4 and must have completed the junior year prior to taking graduate courses. Students are required to maintain this minimum grade-point ratio to continue enrollment in a combined degree program.
2. Graduate Record Examination (GRE) scores are not required to be submitted as part of their Graduate School application; however, applicants are encouraged to submit GRE scores to receive full consideration for graduate fellowships and assistantships upon completion of the BS degree.
3. Up to six semester hours from any 600- or 800-level civil engineering courses may be used to satisfy the requirements of the BS degree. These courses may be counted as technical requirements or electives. Undergraduate students are required to have selected one of their technical requirements from the area of transportation systems, geotechnical engineering, or environmental engineering.

4. Since approval of the graduate program of study is required by the student's graduate advisory committee, students should consult with their academic advisors before selecting courses to be included in the graduate program.

5. Students in a combined degree program are conditionally accepted to the graduate program until completion of the BS degree requirements. Students are not eligible for graduate assistantships until full acceptance is granted.

Students interested in this combined degree program should consult the Civil Engineering Graduate Program Coordinator, the undergraduate advisor, and the Civil Engineering Honors Coordinator (if applicable). Students pursuing an optional emphasis area in their undergraduate degree program may substitute 600-level courses for any 400-level counterpart taken to meet the requirements of an emphasis area. Application for this program should be made by the end of the junior year, but no later than one semester prior to expected BS graduation. Application details are available in the *Academic Regulations* section of this catalog.

## COMPUTER ENGINEERING

### Master of Science

#### Doctor of Philosophy

The Computer Engineering program is a combination of computer software, hardware, systems, and applications. Areas of specialization include computer systems architecture, communication networks, digital signal processing, and intelligent systems. Enrollment is open to graduates in any branch of engineering, computer science, or applied mathematics who have an appropriate engineering and/or science background.

For the MS program, students may write a thesis or follow a nonthesis option. The thesis option requires a total of 30 credit hours including six hours of thesis research. For the nonthesis option, 33 credit hours of coursework must be completed.

The PhD degree requires at least 24 credit hours of graduate coursework beyond the master's degree. Specially qualified candidates with a BS degree may apply for direct entry to the PhD program in any of the above areas. The program of study and hours required beyond the baccalaureate degree are specified by the focus area, but must be at least 66 hours including coursework and research credit.

The department participates in the University telecampus program which serves off-campus students. Further information is available through the Office of Off-Campus, Distance, and Continuing Education.

Detailed information on program requirements and application procedures is available on the Web at [www.ece.clemson.edu/ecenew/index.shtml](http://www.ece.clemson.edu/ecenew/index.shtml).

## COMPUTER SCIENCE

### Master of Science

#### Doctor of Philosophy

To receive full admission to graduate study in computer science, a student must have taken intermediate-level undergraduate computer science, including computer organization and data representation, machine and assembly language programming, data structures, file organization and processing, programming systems, theory of computation, and software methodology; and basic mathematics including calculus, probability and statistics, and discrete mathematics.

An applicant with minimal deficiencies may be admitted provisionally, while one with several deficiencies may be required to complete satisfactorily prerequisite work as a postbaccalaureate student prior to admission as a graduate student.

A candidate for the MS degree must satisfactorily complete an approved program of at least 30 graduate hours. Students may elect one of three options to satisfy the degree requirements: the research experience, research paper, or thesis option. These options allow the student to count zero, three, or six hours of research credit respectively toward the 30-hour requirement. Students may take up to six hours of approved courses in areas outside the department.

Although formal course requirements for the PhD degree are minimal, a typical program requires two to four years of study beyond the MS degree. Each candidate is required to pass a comprehensive examination, a dissertation proposal, and a defense of the dissertation.

### Combined Bachelor's/Master's Plan

Computer Science undergraduates may begin a Master of Science degree program while completing the Bachelor of Science degree and use a limited number of courses to satisfy the requirements of both their undergraduate and graduate degrees. The following requirements apply:

1. Undergraduate students must have a minimum cumulative grade-point ratio of 3.4 and must have completed the junior year prior to taking graduate courses. Students are required to maintain this minimum grade-point ratio to continue enrollment in a combined degree program.
2. Graduate Record Examination (GRE) scores are not required to be submitted as part of the Graduate School application; however, applicants are encouraged to submit GRE scores to receive full consideration for graduate fellowships and assistantships upon completion of the BS degree.
3. Students in a combined degree program are conditionally accepted to the graduate program until completion of the BS requirements. Students with this conditional acceptance are not eligible for a graduate assistantship until the conditional acceptance is removed.
4. Up to nine semester hours from any 600- or 800-level computer science courses may be used to satisfy the requirements of the BS degree.



5. Graduate courses taken as an undergraduate may be included in the graduate program of study; however, any 600-level course that has a corresponding required 400-level counterpart in the BS or BA in Computer Science or the BS in Computer Information Systems may not be counted toward the MS degree. Since approval of the graduate program of study is required by the student's graduate advisory committee, students should consult with their academic advisors before selecting courses to be included in the graduate program.

Students interested in this combined degree program should discuss it with the Computer Science graduate program coordinator and undergraduate program advisor. Students pursuing Senior Departmental Honors should also meet with the Computer Science Honors Coordinator. Application to this program should be made by the end of the junior year but may be made at any time from the junior year until one semester prior to the expected BS graduation. Application details are available in the *Academic Regulations* section of this catalog.

The Computer Science Faculty envision students enrolled in this combined degree program will typically complete nine hours of graduate credit while completing their BS degree requirements and complete the remaining requirements for the MS degree in one calendar year or less of graduate study.

## DIGITAL PRODUCTION ARTS

### Master of Fine Arts

The Digital Production Arts program is a professional degree program offered jointly with the College of Architecture, Arts, and Humanities. See page 50 for the complete program.

## ELECTRICAL ENGINEERING

### Master of Engineering

### Master of Science

### Doctor of Philosophy

Students in Electrical Engineering may direct their programs toward the fields of communication systems and networks, digital signal processing, intelligent systems, applied electromagnetics, electronics, or power systems.

For the MS program, students may write a thesis or follow a nonthesis option. The thesis option requires a total of 30 credit hours including six hours of thesis research. For the nonthesis option, 33 credit hours of coursework must be completed.

The Master of Engineering is a special degree offered for off-campus students through the University telecampus program. Degree requirements include 24 credit hours of coursework and six hours of credit for an engineering report. Additional information is available from the Office of Off-Campus, Distance, and Continuing Education.

The PhD program requires at least 24 credit hours of graduate coursework beyond the master's degree. Specially qualified candidates with a BS degree may

apply for direct entry to the PhD program in any of the above areas. The program of study and hours required beyond the baccalaureate degree are specified by the focus area, but must be at least 66, including coursework and research credit.

Detailed information on program requirements and application procedures is available on the Web at [www.ece.clemson.edu/ecenew/index.shtml](http://www.ece.clemson.edu/ecenew/index.shtml).

## ELECTRONIC COMMERCE

### Master of Electronic Commerce

The College of Business and Behavioral Science and the Department of Computer Science jointly offer and administer this program. See page 56 for the complete program description.

## ENVIRONMENTAL ENGINEERING AND SCIENCE

### Master of Engineering

### Master of Science

### Doctor of Philosophy

Environmental engineering and science is concerned with the characterization and control of environmental pollution. Emphasis is placed on applying the fundamental principles of the basic and engineering sciences through research and design to the solution of environmental problems in natural and engineered systems.

The MEngr program is designed to build on an ABET-accredited engineering baccalaureate background, while the MS in Environmental Engineering and Science builds on a student's previous engineering or science background. Students with a baccalaureate degree in any branch of engineering, as well as chemistry, physics, geology, biology, or related majors with a strong mathematical background may be admitted to the program.

Students may specialize in one of six areas: environmental health physics, environmental process engineering, environmental radiochemistry, environmental and waste management, environmental fate and transport, or environmental chemistry. Research master's degree candidates must complete 24 hours of coursework and six hours of research culminating in the presentation of a satisfactory thesis for MS candidates or a special problem report for MEngr candidates. The MS nonthesis option, which requires 30 hours of coursework and three hours of independent study, is available. The coursework for all master's students must include EE&S 802, 843, and 851. A final examination is required of all master's candidates.

The PhD program is directed toward providing the student with a comprehensive background in the fundamental aspects of environmental engineering and science. The major field of study is generally interdisciplinary in nature, consisting of coursework in several areas of engineering and the basic sciences. Each student's curriculum and research program is tailored to suit his/her personal and professional goals. Qualifying, comprehensive, and final examinations are required. No foreign language is required.

## ENVIRONMENTAL TOXICOLOGY

### Master of Science

### Doctor of Philosophy

The Environmental Toxicology program is jointly administered with the College of Agriculture, Forestry, and Life Sciences. See page 45 for the complete program.

## HYDROGEOLOGY

### Master of Science

The Master of Science in Hydrogeology is an interdisciplinary program that focuses on groundwater geology and subsurface remediation and draws on the expertise of faculty in the Department of Geological Sciences and the Department of Environmental Engineering and Science. The curriculum is structured to impart a strong background in field experimentation complemented by laboratory studies and computer modeling.

Candidates for the Master of Science degree in Hydrogeology should have a baccalaureate degree in the geosciences; however, students having a strong undergraduate background in other fields of science or related engineering disciplines may be admitted but will be required to correct deficiencies in their geological education during the first year. Specifically, GEOL 101/103, 206, 302; and 314, 316 (or an equivalent), or 413 are required. Students entering this program should also have a strong mathematics background; normally, two semesters of calculus are required and a third semester is recommended.

The degree requires 24 credit hours of coursework and six hours of thesis research. Candidates must write a thesis based on original research and defend it in an oral examination. Students may pursue a variety of research projects in hydrogeology and related areas such as environmental geochemistry, geophysics, sedimentology/stratigraphy, and multiphase flow modeling. For students on leave from industry, a special nonthesis option is available which requires 30 credit hours of coursework and a comprehensive written examination.

All candidates must take at least six core courses from a department-approved list. These six courses must include a modeling course (GEOL (EE&S) 808 is recommended), a field course (GEOL 875 is recommended), and a minimum of three other 800-level geology courses.



## INDUSTRIAL ENGINEERING

### Master of Science

### Doctor of Philosophy

Industrial engineers design, develop, and improve integrated systems that include people, materials, information, equipment, and energy. In addition to these issues, graduates learn to address communications throughout the organization while completing their specialized education. Focus areas for specialization are human factors/ergonomics and production and service systems. Work at the doctoral level includes independent research, dissemination of findings, and preparation for research and teaching careers.

Students with a baccalaureate degree in engineering, the physical sciences, mathematics, or related majors with a strong mathematical background may be admitted into the program. Entering graduate students are assumed to have competence in calculus, probability and statistics, calculus-based physics, and computing. Students admitted without this background will be required to successfully complete additional courses, some of which may not carry graduate credit.

Students admitted to the MS program may select a thesis or nonthesis option. Students in the thesis option must complete a minimum of 30 graduate credit hours of coursework including six credits of thesis research. Students in the nonthesis option must complete a minimum of 33 graduate credit hours of coursework.

The PhD program provides the student with a comprehensive knowledge of the field of industrial engineering and a mastery of the methods of research. A minimum of 48 graduate credit hours of coursework beyond a baccalaureate degree is required. Since the dissertation is mandatory for all PhD candidates, 18 credit hours of doctoral research are required. A qualifying examination is required, in addition to examinations required by the Graduate School. Additional information is available on the Web at [www.ces.clemson.edu/ie/](http://www.ces.clemson.edu/ie/).

### Undergraduates Involved in Graduate Programs

Undergraduate students majoring in Industrial Engineering at Clemson may take courses for graduate credit in two ways.

1. Seniors with a minimum cumulative grade-point ratio of 3.0 may apply to take graduate courses while continuing to pursue their bachelor's degrees. If successfully completed, these courses may be eligible to be counted towards a master's degree. Students selecting this option *will not* be allowed to count these courses towards their bachelor's degree. Please see Graduate School form GS-6 for details.

2. Students with a minimum cumulative grade-point ratio of 3.4 may apply to take up to 12 semester hours of courses and have them count towards *both* the bachelor's and master's degrees in Industrial Engineering. To take advantage of this opportunity, students must have a minimum cumulative grade-point ratio of 3.4, must have completed the

junior year, and must have been admitted to the graduate program prior to enrolling in courses. Courses eligible for this program include IE 652, 656, 660, 665, 685, 687, 689, 691, 800, 802, 803, 804, 809, 811, 812, 813, 860, 865, 871, 880, 886, 888, and 893. The Undergraduate Curriculum Committee has preapproved these classes as acceptable technical and free electives in a student's bachelor's program. Determination of whether the classes count towards the master's degree will be made by the student's advisory committee after he/she becomes a full-status graduate student. Students should notify the Graduate Coordinator in writing that they wish to be considered for this program. Enrollment guidelines and procedures can be found under *Academic Regulations* in this catalog.

In both programs, the decision on whether courses count towards the bachelor's degree is determined by the undergraduate committee and whether they count towards the master's degree is determined by the advisory committee that is formed after the student becomes a full-status graduate student.

Students should consult with their undergraduate advisor, the Graduate Coordinator, and/or the Honors Coordinator before enrolling in graduate courses.

## MATERIALS SCIENCE AND ENGINEERING

### Master of Science

### Doctor of Philosophy

Materials science and engineering is concerned with the production, properties, and microstructure of the solid materials that are often the primary limitation to the advancement of modern technology. Emphasis is placed on applying the fundamental principles that govern the structure of the solid state to produce optimum mechanical, electrical, optical, and other physical properties.

The curriculum provides for specialization in metallurgy, glasses and ceramics, and polymeric materials including electronic materials, biomaterials, polymer and fiber science, textile science, polymer and textile chemistry, and fiber and composite materials.

The Materials Science and Engineering program prepares graduate students to apply science and engineering principles to solve problems related to the scientific understanding, characterization, and development of new technology necessary for the processing and manufacturing of different materials and related products.

Students with a baccalaureate degree in any branch of engineering, as well as chemistry, physics, and biology majors with strong mathematical backgrounds, may be admitted to the program. The program is designed to produce engineers and scientists whose degrees represent specialization coupled with a broad foundation in all materials.

Master's degree candidates must complete 24 credit hours of coursework and six credits of research. Of these 24 credit hours, a maximum of 12 credits may be taken from 600-level courses. Each master's degree student must take MS&E 826 and 827.

The Doctor of Philosophy degree provides the student with a comprehensive foundation in materials science and engineering. The major field of study is generally interdisciplinary in nature, consisting of coursework in several areas of engineering and science. Qualifying, comprehensive, and final examinations are required. No foreign language is required, but proficiency in one is recommended.

Both MS and PhD students must take at least one of the following courses—students should consult with their advisors when making the decision: EX ST 801, 805, MTHSC 805, 806, 808. All students must enroll in MS&E 800 every semester.

## MATHEMATICAL SCIENCES

### Master of Science

### Doctor of Philosophy

Entering students are expected to have courses in linear algebra, differential equations, a computer language, and statistics.

For the master's program, both thesis and nonthesis options are available. The curriculum for both options includes foundation courses (advanced calculus, modern algebra, probability, and discrete computing—courses often taken prior to entering the master's program); a breadth requirement (a course from each of algebra, analysis, computing, operations research, and statistics plus one additional course in operations research or statistics); and a concentration area (six courses selected to define an identifiable specialty area). Every student's program is required to include at least one course, possibly chosen from outside the Department of Mathematical Sciences, that emphasizes mathematical modeling. A minimum of 36 graduate credit hours is required for the master's degree. In addition, students in the nonthesis option are required to complete a one-credit-hour project course.

Together with the Department of Mathematics at Kaiserslautern University in Germany, the department offers an exchange program in mathematical sciences. In this program, one year is spent at the host university so that students can obtain two MS degrees, one from their home university and one from the host university. The degree requirements for the Clemson degree are identical to those for the nonthesis MS option.

Students in the doctoral program are expected to satisfy the master's program requirements prior to receiving their doctorate. Including master's study, a doctoral program must have two courses from each of the major areas of the mathematical sciences (algebra, analysis, computing, operations research, and probability/statistics) and generally consists of 60 credit hours of graduate coursework. Students are admitted to candidacy for the PhD degree upon successful completion of a preliminary examination and the comprehensive examination. The preliminary examination consists of tests in three areas chosen from algebra, analysis, computing, operations research, statistics, and stochastic processes. The comprehensive exam assesses the student's readiness to perform independent research and competency in advanced graduate material. A student's



PhD program must include both a concentration area and a supporting area. Additional information on the MS and PhD programs can be found on the Web at [www.math.clemson.edu/](http://www.math.clemson.edu/).

Mathematical sciences courses at the 700-level are applicable to master's degree programs in the School of Education only.

## MECHANICAL ENGINEERING

### Master of Science

#### Doctor of Philosophy

Enrollment in the MS and PhD programs is open to students with degrees in physics, applied mathematics, or any branch of engineering.

Students in the MS degree program may choose the thesis or nonthesis option. Students in the thesis program must complete 30 credit hours of coursework, including six hours of thesis research, and write a thesis. Students in the nonthesis program must complete 33 credit hours of coursework and pass an exit examination. Students in the PhD program must pass a qualifying exam, complete 18 hours of dissertation research, and defend a dissertation.

Programs may be selected with concentrations in mechanical and manufacturing systems design (CAD/CAM, kinematics and dynamics, materials, robotics, and vibrations), thermal/fluid sciences (fluid mechanics, heat transfer, thermodynamics, and energy systems), or engineering mechanics (solid mechanics, composite materials, numerical methods, experimental methods, and dynamics).

## PHYSICS

### Master of Science

#### Doctor of Philosophy

Graduate studies in physics and astronomy may be pursued by well-prepared students in the physical and mathematical sciences or engineering. As the basic physical science, physics offers unparalleled intellectual opportunities. Theoretical, experimental, or computer-simulated studies of the physical universe, ranging from the macroscopic studies of cosmology to the microscopic world of quanta, are available.

Students beginning graduate studies in physics and astronomy usually enter the MS program. After two semesters, well-prepared students are ready to begin a research program. This program usually culminates in a thesis, although a nonthesis option is available. For the thesis option, 30 credit hours and a final oral examination on the general area of study and thesis defense are required. In the nonthesis option, 36 credit hours are required, including six credit hours of PHYS 890. A written report must be submitted on the directed studies. A final oral examination on the general area and directed activities completes the requirements for the nonthesis option.

Study for the PhD degree begins with the general qualifying examination. A sufficiently high score on this examination may make it possible for a student to bypass the master's degree. An oral examination on the general research area is given within six months after completion of the written qualifying examination. At least three weeks prior to the convocation at which the student expects to receive the PhD degree, a final oral examination on the dissertation must be completed.

## TEXTILES, FIBER AND POLYMER SCIENCE

### Master of Science

#### Doctor of Philosophy

The MS degree program in Textiles, Fiber and Polymer Science requires previous undergraduate study in chemistry, physics, mathematics, polymer or fiber science, or an engineering discipline. Students take advanced courses in fiber science, chemistry, physics, textile structure formation, engineering, computer science, and other appropriate areas of study as determined by their graduate committees. Students may concentrate in polymer and textile chemistry, textile structure formation, textile science, or polymer science. Areas of study include fiber chemistry, fiber physics, chemistry of dyeing, polymer chemistry and physics, advanced polymer systems for fiber and film applications, smart fibers, and others. This degree is highly multidisciplinary in nature. Applicants usually have a BS degree in one of the base sciences or engineering disciplines, mathematics, computer science, textile science, textile chemistry, life science, or a closely allied field. Students may be accepted into the program with deficiencies in chemistry, physics, and mathematics; but the deficiencies must be remedied with appropriate undergraduate courses within a specified time frame.

The major area of study is normally fiber and polymer chemistry or physics, dye chemistry, textile science, textile materials formation science, composite materials, or other areas of textile, fiber, and polymer science. The minor area of study is usually in chemistry, physics, engineering, computer science, life sciences, or mathematics. Each MS candidate must complete an independent scientific or technical investigation and formally report and defend the methodology, results, and conclusions in a thesis. A minimum of 24 credit hours of coursework and six credit hours of research is required for the MS degree.

Students in the PhD program may choose to concentrate in polymer science, natural and/or man-made fibers, conversions of new fibers into textile structures, polymer chemistry and physics, fiber physics, or coloration science. Students are normally admitted to the PhD program after successfully completing the requirements for an MS degree in a base science, engineering, life science, or textile program. Exceptionally well-qualified students meeting the acceptance criteria for the MS degree may be admitted to the degree program after obtaining the BS degree in one of the aforementioned areas of concentration. Acceptance into

the PhD program directly from the bachelor's degree program is solely at the discretion of the school's graduate admissions committee and the school director acting on their advice. Students in the MS program, who have corrected all deficiencies, may petition their graduate committees to change to the PhD program after successfully demonstrating an ability to perform at the required level.

Qualification to pursue the PhD is accomplished by obtaining a minimum grade of B in at least five courses representative of the major areas of textile and polymer science or by standing special examinations in these areas. Courses currently considered representative are P T C 811, 812, TEXT 821, 835, and 866.

Other courses, tailored to the individual's objectives, are selected by the student and his/her advisory committee. The student normally takes a minor in a selected field of science or engineering and satisfies the requirements established by the minor department. The minor requires a minimum of 12 credit hours.

Admission to candidacy for the PhD degree requires completion of written and oral comprehensive examinations. Each candidate must carry out an independent, original scientific investigation and formally report and defend the methodology, results, and conclusions in a dissertation.



# COLLEGE OF HEALTH, EDUCATION, AND HUMAN DEVELOPMENT

The College of Health, Education, and Human Development offers advanced degrees in Administration and Supervision; Career and Technology Education; Counselor Education; Curriculum and Instruction; Educational Leadership; Elementary Education; Human Resource Development; Middle Grades Education; Nursing; Parks, Recreation, and Tourism Management; Reading; Secondary Education; Special Education; and Youth Development.

The PhD degree is offered in Curriculum and Instruction; Educational Leadership; and Parks, Recreation, and Tourism Management. The MS degree is offered in Nursing; Parks, Recreation, and Tourism Management; and Youth Development. The College also offers professional degree programs leading to the Master of Arts in Teaching; Master of Education; Master of Human Resource Development; Master of Career and Technology Education; Master of Parks, Recreation, and Tourism Management; Specialist in Education; and the Doctor of Education degrees. The College of Health, Education, and Human Development and the College of Agriculture, Forestry, and Life Sciences cooperatively offer a Master of Agricultural Education program.

The focus of the graduate program is on preparing students for leadership positions in educational, health-care, governmental, and business organizations. Clinical and field experiences are common in many graduate programs. Often programs join with local, state, and federal agencies to provide real-world experiences and research projects for faculty and students. Some programs and courses are offered off campus and in the evening to accommodate the schedules of public schools, higher education, health-care institutions, businesses, and other organizations.

The College of Health, Education, and Human Development offers graduate courses in education and nursing at various off-campus locations across the state. Off-campus course schedules for fall, spring, and summer offerings for school personnel, school districts, and other South Carolina agencies are published by the Office of Off-Campus Academic Programs. In addition, courses are taught by contract with local school districts in the Clemson University service region. Courses are offered in athletic leadership and health to provide electives for students in other areas.

## EUGENE T. MOORE SCHOOL OF EDUCATION

The mission of the Eugene T. Moore School of Education is to prepare outstanding, reflective practitioners in education and human resource development through the provision of diverse experiences in content, method, and research that empower professionals to be effective members of the communities in which they live and serve.

The School of Education trains teachers, counselors, and leaders for the P-12 schools and prepares training and development specialists for business and industry.

The School of Education embraces its conceptual framework of empowered professionals educating a diverse world. These professionals utilize the knowledge of curriculum, technology, assessment, and instructional/leadership/counseling strategies to effect learning for diverse populations. Clemson University provides resources for courses and clinical experiences in method, research, and content knowledge which enable professionals to be reflective practitioners. Such practitioners are knowledgeable, ethical, caring decision makers responding to local, state, and world needs.

Clemson University is accredited by the National Council for the Accreditation of Teacher Education (NCATE) and the state of South Carolina for the preparation of educational personnel in South Carolina in Early Childhood Education; Elementary Education; Special Education; and secondary school programs in Agriculture, Biological Sciences, Economics, English, History, Mathematics, Modern Languages, Physical Sciences, Political Science, Psychology, Sociology, Technology Education; as well as Administration and Supervision, Career and Technology Education, Counselor Education, Curriculum and Instruction, and Educational Leadership.

In addition, there are programs in Human Resource Development at both the undergraduate and graduate levels designed to prepare competent professionals for a variety of education, training, and development settings within industrial, business, and public sector environments.

The Eugene T. Moore School of Education has designated a series of courses to meet the growing demand for continual professional development in the state. ED 735 is used for recertification and non-degree purposes.

### Transition to Teaching

The South Carolina Transition to Teaching Alternative Route to Certification (T3 ARC) is a state-approved program designed to enable active-duty military personnel or retirees who have appropriate bachelor's degrees to obtain the requisite knowledge, skills, and certification to become teachers in South Carolina schools. The T3 ARC is a collaborative program between Clemson University, the University of South Carolina, South Carolina State University, and The Citadel. For more information, contact the T3 ARC office at (864) 656-8883, or visit the Web at [www.hehd.clemson.edu/TTT/](http://www.hehd.clemson.edu/TTT/).

## ADMINISTRATION AND SUPERVISION

### Master of Education Specialist in Education

#### Master of Education

The Master of Education degree in Administration and Supervision prepares teachers with at least one year of experience as elementary or secondary school administrators or supervisors. The program provides a theoretical foundation in effective educational leadership, blended with insights into the practical exercise of such leadership.

#### Admission Requirements

Complete application package should include minimum GRE scores of 830 on math and verbal and a 4 in writing or a Miller's Analogy Test score of at least 389, a minimum of one year of teaching experience or equivalent, official transcripts, two letters of recommendation, and an undergraduate grade-point ratio of 3.0 on a 4.0 scale.

#### Program Requirements

This program incorporates the academic requirements for certification as a principal and supervisor in South Carolina. Forty-two hours of graduate credit are required.

*Core Courses*—Students must complete the following core courses. Courses must be taken in sequence within three levels:

Level I—ED L 700, 710, 730, 735, 750 or 755, 795. Four of the six must be completed before attempting Level II or Level III.

Level II—ED F 778, ED L 705, 720, 725. Three of the four must be completed before attempting Level III courses.

Level III—ED L 715, 740, 745, and 750 or 755

#### Specialist in Education

The Educational Specialist degree in Administration and Supervision prepares students as senior-level school administrators. The program provides the academic requirements for certification as a superintendent in South Carolina. Additionally, it fulfills the certification requirements of states which specify the completion of a nationally accredited two-year program of graduate study leading to certification as a school administrator.

#### Admission Requirements

Complete application package should include a master's degree, minimum GRE scores of 855 on math and verbal and a 4 in writing or a Miller's Analogy Test score of at least 391, official transcripts, two letters of recommendation, and a minimum grade-point ratio of 3.25 on all previous graduate work.

Students must be certified as principals prior to formal admission to the EdS program. Students without certification must fulfill the program requirements for principal certification before they can be admitted to candidacy for the EdS degree. Candidacy is defined as the final 21 hours of the program (Level II and Level III courses).



**Program Requirements**

*Core Courses*—Students must complete the following core courses. Courses must be taken in sequence within three levels:

Level I—ED L 805, 820, 850

Level II—ED L 810 or 950, and 815

Level III—ED L 830, 839, 840, 850

## CAREER AND TECHNOLOGY EDUCATION

### Master of Career and Technology Education Doctor of Education

**Master of Career and Technology Education**

The Master of Career and Technology Education degree allows for specialization in three areas: industrial technology education, career and technology education, and administration and supervision for the two-year college.

Sufficient flexibility is permitted to structure each student's plan of study to meet the objectives for any of the areas of specialization above. The Industrial Technology Education concentration is designed to enhance competence in teaching industrial technology and career education. Those who want to improve their competence in teaching and administering career and technology subjects in secondary or postsecondary institutions specialize in the Career and Technology concentration. The program in Administration and Supervision for the Two-Year College is designed specifically for persons preparing for administrative or supervisory positions in the technical colleges.

**Admission Requirements**

Complete application package should include an undergraduate grade-point ratio of 3.0 on a 4.0 scale, acceptable GRE scores, and departmental approval. Industrial Technology Education applicants must hold or meet the minimum requirements for an industrial technology teacher's certificate. Career and Technology Education applicants must hold or meet minimum requirements for an engineering and industrial technology teacher's certificate, or they must show technical competence through training, work experience, or proficiency test results. The program in Administration and Supervision for the Two-Year College requires the applicant to show evidence of competence in a teaching area or to have a minimum of 24 credit hours of courses appropriate to the technical program to be administered or supervised.

All three concentrations require the same 15 credit hours of core courses with a minimum 3.0 grade-point ratio and the successful completion of an oral comprehensive examination. Students may choose either a 30-hour program that requires the completion of a thesis or a 36-hour nonthesis program. The nonthesis option requires the completion of a creative component under the guidance of an advisor.

*Core Courses*—AG ED (CTE, ED) 889, THRD 686, VT ED 810, 833, 850

*Concentrations*—Some concentrations require a minimum number of hours in technical electives; students should consult their advisors for more information.

### Administration and Supervision for the Two-Year College Concentration

After consulting with their committees, students may choose from the following courses to complete the required number of credit hours for the concentration (nine hours for the thesis option or 18 hours for the nonthesis option): CTE 815, 865, ED C 803, 815, ED F (AG ED, THRD) 680, (AG ED, THRD) 682, ED L 720, 725, 730, 735, 745, 805, 810, 830, ED L (VT ED) 955, H R D (CTE) 845, (CTE) 860, THRD 668, VT ED 812, 861, 876.

For this concentration, six research credits are required: CTE 895 plus three additional research credits selected from CTE 894, 896, ED L 840, EX ST 801, 805, VT ED 882, 980.

### Career and Technology Education Concentration

Students in the Career and Technology Education Concentration must take CTE 815, 865, H R D (CTE) 860.

After consulting with their committees, students may choose from the following courses to complete the required number of credit hours for the concentration (nine hours for the thesis option or 18 hours for the nonthesis option): CTE 820, 894, 895, 896, ED C 812, ED F 808, ED L 715, EX ST 801, H R D (CTE) 846, (CTE) 847, VT ED 861.

Candidates preparing to teach technical subjects should select electives to enhance their individual competence. In addition to regular classes, these strengths may be developed through enrollment in such experiences as THRD 692, which may be taken for one to six credits. The particular technical electives should be carefully planned by the student and advisor.

### Industrial Technology Education Concentration

Students in the Industrial Technology Education Concentration must take CTE 865 and 895.

After consulting with their committees, students may choose from the following courses to complete the required credit hours for the concentration (nine hours for the thesis option or 18 hours for the nonthesis option): CTE 815, 820, 851, 852, 853, 854, 896, ED (CTE) 700, ED C 815, ED F (AG ED, THRD) 682, 701, 702, 808, ED L 715, 725, ED SP 823, H R D (CTE) 845, (CTE) 846, (CTE) 860, READ 864, THRD 610, 668, 683, 692, VT ED 861.

Special Institute Courses may substitute for certain requirements in the Industrial Technology Education concentration. See advisor for applications.

**Doctor of Education**

The Doctor of Education degree in Career and Technology Education (CTE) prepares graduates for leadership positions in the profession. Curricula are designed for career and technically oriented personnel in colleges and universities, public schools, industry, and career oriented agencies.

The program for the Doctor of Education degree in CTE may involve all of the colleges of the University. Existing programs in other colleges provide an opportunity for the acquisition of technical knowledge and skills from the broad spectrum represented in career and technology education and human resource development. Broad program offerings allow students considerable latitude in following their areas of interest.

A minimum of 12 credit hours of coursework is required outside the education area. It is anticipated that a number of students will desire additional courses to enhance their career and/or technical competence in their professional fields.

Arrangements for such a program are encouraged by the CTE departments/areas and have been agreed to by the various colleges of the University. Provision has been made for faculty members from other colleges to be named to the candidates' advisory committees. These advisory committee members help formulate the candidates' programs by furnishing expertise in selecting meaningful sequences of courses in their respective schools and colleges.

Areas of specialization include administration, guidance, curriculum and instruction, human resource development, and teaching. These areas give a general structure to coursework selections and research emphases but are not prescriptive in nature.

**Admission Requirements**

Complete application package should include a letter of application and a résumé sent to G-01 Tillman Hall, Clemson University; a master's degree; a grade-point ratio of 3.5 on a 4.0 scale; a GRE composite score of 1450 (minimum of 450 on the verbal section) or a suitable Miller's Analogy Test (MAT) score (must be no older than five years and from a single administration of the exam); completion of three years of successful experience in the proposed field of professional study (may be waived for admission but must be met before applicant can become a candidate for the degree); and an interview. Students whose native language is not English must take the Test of English as a Foreign Language (TOEFL), preference being given to those applicants who score a minimum of 575.

**Degree Requirements**

The following academic requirements must be completed by each student: a minimum of 80 hours of graduate credit beyond the bachelor's degree plus a dissertation (98 total hours); a maximum of 48 credit hours of transfer credit is allowed; a minimum of 14 hours of graduate credit in statistics and research; an internship for six credit hours, approved by the advisory committee; a minimum of 18 hours of graduate credit in candidate's area of specialization or professional interest; no coursework from the master's degree may be used to satisfy this requirement and must be approved by graduate committee; a minimum of 12 credit hours of graduate coursework required from departments/areas other than agricultural education, technology and human resource development, graphic communications, or any area in education; and a minimum of 18 credit hours of dissertation research.



The following courses (or equivalents) are required of all students in meeting the degree requirements:

*Career and Technology Foundation*—Twelve credit hours are required: VT ED 810, 812, 833, 850.

*Research and Statistics*—14–15 credit hours are required: AG ED (CTE, ED) 889, EX ST 801, 803 or PSYCH 810, VT ED 882, 893

*Other Requirements*—VT ED 980, 991

## COUNSELOR EDUCATION

### Master of Education

The Master in Education in Counselor Education, a CACREP-accredited program, prepares students in one of the following specialty areas: community counseling, school counseling, or student affairs. Graduate education in the Counselor Education program helps students realize their potential as practicing counselors and higher education administrators, engage in professional relationships, and develop a set of meaningful professional values. To this end, the program reflects current knowledge from lay and professional groups concerning current and projected counseling and human development needs of a pluralistic society. Cultural considerations are emphasized so that the experiences provided will be rewarding and useful in today's ever-changing society.

The faculty of the Counselor Education program is dedicated to educating and training counselor education professionals to function in culturally diverse settings. This program utilizes an "integrative practitioner training" model emphasizing development, prevention, enhancement, and the diagnosis and remediation of psychological disorders. The programs are designed to provide a challenging, yet supportive, environment that promotes professional orientation, practice, and self-awareness.

Clemson University recognizes laboratory settings and field-based experiences as providing the student with a realistic perspective on the field; an integrating experience for knowledge and skills acquired in the classroom; a situation that maximizes self-awareness, self-direction, and self-evaluation; and feedback on his/her progress and development.

Clemson University acknowledges the importance of close supervision in practica or internship placements as a means of maximizing student training and preventing inadvertent harm to clients. Practica and internships are designed so that the focus and intensity of supervision will change as students acquire competent beginning, intermediate, and advanced skills. The University supervisor provides each supervisee with periodic performance and evaluation feedback throughout the supervised experience. At no point is any student to engage in any field-based practica experience without the permission of the major advisor.

Practica require 100 hours and internships, 600 hours of on-site counseling and/or administrative activities, a minimum of one hour of individual supervision per week, a formal log of all activities, and regular meetings with the student's University and site supervisors.

Each student is assigned a major advisor chosen from the Counselor Education faculty. Students are required to meet with their advisor at least once a semester to ensure appropriate course sequencing.

Upon completion of 33 hours, the student may be given permission by his/her major advisor to take the comprehensive examination. It is the student's responsibility to have an approved plan of study on file prior to taking the comprehensive examination and to make sure that his/her name is on the list to take the comprehensive examination.

### Admission Requirements

Applicants must be admitted to the Graduate School; have an undergraduate grade-point ratio of 3.0 on a 4.0 scale (last 60 hours of undergraduate coursework); have acceptable GRE scores; submit a letter of intent; include two letters of recommendation; and obtain approval of the Counselor Education faculty via a department interview. Applications for summer and fall admission are due by March 1; for spring admission, October 1. Applications will be reviewed only twice a year.

The Community Counseling Emphasis also requires a minimum of 12 credit hours of psychology and/or sociology, graduate or undergraduate.

*Program Objectives*—The student will (1) develop respect for the dignity and worth of the individual; (2) develop commitment to the fulfillment of human potential; (3) understand educational and counseling processes; (4) gain knowledge in his/her particular field of counseling; (5) develop competence in the application of professional expertise in counseling; (6) gain knowledge of the role and function of professionals in related fields; (7) develop a commitment to inquiry; and (8) develop maturity in self-development.

Additional information is available on the Web at [www.hehd.clemson.edu/schoolofed/graduate.htm](http://www.hehd.clemson.edu/schoolofed/graduate.htm).

### Testing Requirements

Passing the departmental comprehensive examination is required for the degree. Upon completion of 33 hours in the program and with the advisor's permission, students are eligible to take the program's comprehensive examination: the Counselor Preparation Comprehensive Examination (CPCE)—a four-hour written examination. The examination is given every semester, and passing it is required for graduation.

The CPCE is a 160-question, multiple-choice test. All Counselor Education students are required to take the CPCE approximately two months prior to the administration of the written comprehensive exam. Students are then required to meet with their advisors to discuss their scores and to prepare for and schedule the written comprehensive examination.

The written comprehensive exams are graded on a pass/fail basis. At least two committee members must pass the student. If a student does not pass the written comprehensive examination, the major advisor may recommend a second written or oral examination. This recommendation may be during the same semester or in the following one. If the student fails the written comprehensive examination twice, he/she will be removed from the program.

## Community Counseling Emphasis

Students with an emphasis in Community Counseling will demonstrate an ability to work effectively with community and other agency personnel; an ability to meet qualifications for certification or licensure; understanding and skills related to counseling needs in the environment in which they choose to work; a high degree of self-understanding; an ability to communicate effectively with diverse cultural groups; a knowledge about counseling across the lifespan; human evaluation and research skills; a high degree of sensitivity and acceptance of others' behavior; an awareness of responsibilities specific to a variety of community agencies; and ethical practices. Additional information is available on the Web at [www.hehd.clemson.edu/schoolofed/](http://www.hehd.clemson.edu/schoolofed/).

The Community Counseling Emphasis requires 51 credit hours arranged as follows:

*Area of Specialization*—42 credit hours: ED C 805, 810, 811, 812, 813, 814, 815, 816, 818, 821, 822, 823, ED F 701, 778

*Field Experiences*—nine credit hours of ED C 836, 846. Students must complete 21 credit hours before participating in internship.

## School Counseling Emphasis

Students with an emphasis in School Counseling will demonstrate an ability to work effectively with students, teachers, administrators, and other members of the community as well as a high level of expertise in counseling appraisal, theory, skills, and intervention techniques.

Qualification for state and national certification as school counselors includes an ability to conduct a comprehensive and developmental school guidance and counseling program; a healthy self-awareness and understanding; counseling within the framework of their respective association's legal and ethical standards; ability to counsel with sensitivity, caring, and an appropriate approach in diverse environments; and ability to perform in a consultative capacity both within and outside of the school environment. Additional information is available on the Web at [www.hehd.clemson.edu/schoolofed/](http://www.hehd.clemson.edu/schoolofed/).

The School Counseling Emphasis requires 51 credit hours, arranged as follows:

*Foundations*—six credit hours: ED F 701, 778

*Area of Specialization*—36 credit hours: ED C 801, 807, 810, 811, 812, 813, 814, 815, 816, 818, 821, 822

*Field Experiences*—nine credit hours: ED C 830, 841

### Testing Requirements

In addition to the CPCE and written comprehensive examination, the guidance section of the National Teacher's Exam (PRAXIS) must be passed and the score recorded in the student's file before certification verification will be sent to any State Department of Education.



## Student Affairs Emphasis (Administration and Counseling)

Students with an emphasis in Student Affairs will demonstrate (1) the ability to work effectively with faculty, students, administrators, and other members of the academic community; (2) preparation for employment in higher education settings in a variety of roles; (3) the ability to act as consultants throughout the higher education setting; (4) understanding and skills related to counseling and developmental needs at the postsecondary level; (5) a high degree of self-understanding; (6) the ability to communicate effectively with all cultural groups; (7) a high degree of sensitivity and acceptance of diversity in thought and action; (8) an awareness of the responsibilities of student affairs practitioners to the developmental needs and maintenance of quality experiences for students, faculty members, administrators, and staff; and (9) ethical practice.

The Student Affairs Emphasis requires 48 credit hours arranged as follows:

*Core Courses*—27 credit hours: EDC 803, 804, 810, 811, 812, 814, 815, 819, and three elective hours

*Field Experiences*—nine credit hours: EDC 834, 844

*Area of Specialization*—12 credit hours as follows:

*Student Affairs Practice in Higher Education (Administration)*—EDC 806, 809, ED L 765, 855

*Student Affairs Counseling*—EDC 805, 813, EDF 701, 778

The written comprehensive exams are graded on a pass/fail basis. At least two committee members must pass the student. If a student does not pass the written comprehensive examination, the major advisor may recommend a second written or oral examination. This recommendation may be during the same semester or in the following one. If the student fails the written comprehensive examination twice, he/she will be removed from the program.

## CURRICULUM AND INSTRUCTION

### Doctor of Philosophy

The Doctor of Philosophy degree in Curriculum and Instruction is a research degree that prepares students to become scholars who can discover, integrate, and apply knowledge, as well as communicate and disseminate it. The intent of the program is to prepare students to make significant original contributions to knowledge in specialized fields. The program prepares students in one of the following specialty concentrations: elementary education, English education, mathematics education, science education, social studies education, reading education, or special education. These areas provide a general structure of coursework selections and research emphases; however, students are encouraged to work with faculty to design programs uniquely fitted to their areas of interest. The program of study for the degree is determined by the student's advisory committee.

Every doctoral student must satisfy all requirements of the Graduate School as well as requirements in

coursework, internships, the comprehensive exam, the dissertation proposal, and oral defense of the dissertation as directed by the student's advisory committee. Students must maintain a B average in all graduate work. The degree usually requires a minimum of 70 credit hours beyond the master's degree, selected from the areas prescribed by the requirements of the PhD in Curriculum and Instruction. Listed below are the guidelines or normal expectations for a student receiving the PhD degree; however, the final determination of the course of study is made by the advisory committee.

Graduate courses designated for professional development are not eligible to be used toward a graduate degree.

A minimum of three to six hours of internship is required as part of each specialty area. An internship of sufficient time and quality of experiences to warrant three to six semester hours of graduate credit must be planned and executed to the satisfaction of the student's advisory committee.

Specialty areas require 6–18 credits in courses outside the School of Education. This approved coursework is intended to provide a concentration within the specialty area and/or exposure to disciplines outside the School of Education.

### Admission Requirements

A complete application package should include proof of a master's degree, grade-point ratio of 3.5 on a 4.0 scale, minimum GRE composite score of 1000, preferred writing score of 5, and relevant professional experiences. A résumé and personal statement must be supplied. An interview may be required. Students whose native language is not English must take the Test of English as a Foreign Language (TOEFL). Preference is given to those applicants who score at least 575. Deadlines for admission consideration are October 15 and March 15.

### Core Requirement Goals

The student will (1) be able to critically analyze social, historical, psychological, personal, and policy factors in the development and current practices of curriculum and instruction; (2) acquire an understanding of the research processes including practical design, analysis, and reporting; (3) understand how to use historical, correlational, descriptive, and experimental methods within research; (4) be able to analyze critically and evaluate research reports; and (5) be able to prepare scholarly, research-based reports and presentations.

### Course Requirements

The Curriculum and Instruction Program requirements are as follows:

*Core Courses*—ED 954, 955, EDF 875, 908, and six additional credits selected from EDF 870, 872, ED L 950, ED SP 853

*Research and Assessment Methodology*—13 credits: ED (ED F, ED SP) 894, EDF 878, 879, EX ST 801

*Specialty Area*—27–30 credit hours, including six hours outside the School of Education. Courses vary according to the area.

*Internship*—three–six hours: ED (ED F, ED SP) 980

*Dissertation*—18 hours of ED (ED F, ED SP) 991

## Elementary Education Emphasis

Students with an emphasis in Elementary Education will demonstrate (1) a research knowledge base of one or more of the academic areas taught in the elementary school with an understanding of how the different areas relate to the learning and instructional needs of all students, including design, implementation, and evaluation of curriculum; effective instructional methods; and current issues and trends affecting teaching and/or learning and (2) competence in basic and applied research and evaluation related to the elementary school, such as curriculum, instruction, and ancillary programs.

The Elementary Education Emphasis Area requires ED (ED F, ED SP) 980, ED EL 937, 938, plus 21 additional credit hours approved by the doctoral committee. A three-hour internship is required.

## Reading Education Emphasis

Students with an emphasis in Reading will demonstrate (1) a research knowledge base in the field of reading with an understanding of the relationship to the learning and instructional needs of all students, including design, implementation, and evaluation of curriculum; effective instructional methods; and current issues and trends affecting teaching and/or learning and (2) competence in basic and applied research and evaluation related to the field of reading, such as curriculum, instruction, assessment, and ancillary programs.

The Reading Education Emphasis Area requires ED (CTE) 700, PSYCH 833, READ 939, 944, plus 12 additional credit hours selected from READ 884, 885, 886, 887, 937, 938, 940, 941, 942, 943, 945. A six-hour internship is also required.

## Secondary Education Emphasis

The PhD program in Curriculum and Instruction with an emphasis in English Language, Mathematics, Natural Sciences, or Social Studies has five possible professional market niches. The student's program for each niche would contain appropriate study in both that subject area and that niche to provide the necessary skills to be a productive professional. These five niches are in English language, mathematics, science, or social studies teacher educator in higher education; a subject-specific curriculum coordinator or curriculum supervisor in a medium to large school district, state department of education, or federal government agency; a teacher of English language, mathematics, science, or social studies in a small four-year or community/technical college; a curriculum developer of secondary English, mathematics, science, or social studies or; an educator of programs in English language, mathematics, science, or social studies in commerce and industry.

*English Education Goals*—Students with an emphasis in Secondary Education–English will demonstrate a research knowledge base that includes current research in the areas of teaching composition, literary response, language development, developments in English language, and multimedia applications for the English classroom. This will occur within a literary canon that celebrates diversity and competency in basic and applied research and evaluation related to English education.



**Mathematics Education Goals**—The emphasis area in Mathematics Education will provide students with instruction and understanding in the mathematics curriculum—what is taught, the process of instruction, how mathematics is taught and assessed, the mathematical knowledge of the teacher—so that students may fulfill a variety of professional responsibilities. In addition, students will acquire the skills necessary to read, interpret, utilize, and conduct research in mathematics education in order to expand the research knowledge base and allow students to apply knowledge to specific professional responsibilities.

**Science Education Goals**—Students with an emphasis in Science Education will demonstrate an understanding of the science education research knowledge base; a knowledge of how science process and content are most effectively learned; familiarity with the components of state-of-the-art curriculum models which are most conducive to learning; and the ability to use the most effective research methodologies designed to expand the theory base.

**Social Studies Education Goals**—Students with an emphasis in Social Studies Education will develop a knowledge base in current social studies issues, research, and classroom applications and an ability to select and pursue appropriate research topics in social studies.

The Secondary Education Emphasis requires 30 credit hours arranged as follows:

**Concentration**—18 credit hours of advanced coursework in a discipline or related areas

**Internship**—three to six credit hours

**Advanced studies in the teaching of English, mathematics, science, or social studies**—three hours from the appropriate area: EDSEC 841, 842, 843, or 844

**Current Literature in Education**—three hours from the appropriate area: EDSEC 846, 847, 848, or 849

## Special Education Emphasis

Students with an emphasis in Special Education will (1) demonstrate a research knowledge base of handicapping and at-risk characteristics integrated with an understanding of how these characteristics relate to the learning and instructional needs of individuals in the delivery of effective curricular and instructional, functional interventions; philosophical and social contexts of special and regular education; and legal and organizational context of special and regular education and (2) demonstrate competence in basic and applied research and evaluation, emphasizing special methodological concerns and evaluation of services with individuals with disabilities and at-risk characteristics.

The Special Education Emphasis requires ED SP 930, 931, 932, 933, 934; six credit hours of coursework outside the School of Education; and six credit hours of ED SP (ED, ED F) 980 (Internship in Curriculum and Instruction).

## EDUCATIONAL LEADERSHIP

### Doctor of Philosophy

The Doctor of Philosophy degree in Educational Leadership provides students with a strong background in two basic academic areas: educational research and educational leadership. It provides students with competencies and skills needed for effective functioning in a formal leadership capacity in an educational (or related service) organization. As the highest academic degree granted by Clemson University, the PhD prepares students to become scholars who can discover, integrate, and apply knowledge. Furthermore, the intent is to produce effective administrators. This preparation enables students to understand and evaluate critically existing knowledge in educational leadership. This is accomplished through close association with and apprenticeship to faculty members experienced in research, teaching, and administration.

A student admitted to the Educational Leadership doctoral program must begin coursework within one year from the semester of acceptance or reapply for admission. Students are discouraged from taking more than six hours of doctoral coursework prior to being admitted to the program. (This does not preclude the use of courses completed in the EdS degree in Educational Administration.)

### Admission Requirements

Complete application package should include minimum GRE scores of 500 on math and verbal and 5.5 in writing, master's degree, official transcripts, three letters of recommendation, and a two-page letter discussing reasons for pursuing the PhD degree. This letter will be used as a writing sample. An interview is optional at the discretion of the selection committee.

### Program Requirements

Graduate programs at the doctoral level must maintain flexibility. The program of study will be developed by the student's program committee and will conform with departmental policy requiring a minimum of 76 graduate credit hours beyond the master's degree, including the 18 hours of research project (ED L 991).

Students who have not completed coursework prerequisites for entrance into the program in Educational Leadership must complete such coursework as specified by the program committee. All preparatory coursework assigned by the program committee must be completed before proceeding with the required program.

**Distance Education Options**—The PhD program in Educational Leadership offers distance education options for both the K-12 and the higher education tracks. Graduate students residing in the Horry County coastal area of the state may be eligible to take K-12 doctoral courses on the campus of Coastal Carolina University in Conway, SC. For the higher education track, doctoral students may be eligible to enroll in classes on a statewide basis through on-line course offerings. In both cases, all requirements remain the same as for the on-campus degree programs, and all courses are enrollment-dependent.

**Core Courses**—The following 15 credits are required: ED L 900, 905, 910, 989, 990

**Concentration**—An 18-hour minimum in the K-12 or Higher Education Concentration is required from the following: ED L 765, 805, 810, 815, 820, 830, 850, 885, 915, 935, 950, (VT ED) 955, 960, 965, 970, 972, 976, 980. Other courses may be approved by the department.

**Research**—Students must complete a qualitative research course (e.g., ED F 879), an intermediate and advanced research course (e.g., EX ST 801, ED F 878) and a directed research course (ED L 995).

### Cognates

Cognates are courses from another area of study. As a part of the program of study, each student must complete six graduate credit hours in a field outside education. All six hours must be from the same discipline and approved by the student's graduate committee.

**Dissertation**—A minimum of 18 credit hours (ED L 991) is required for the dissertation.

**Internship**—All students are required to complete six hours of internship credit (ED L 985).

## ELEMENTARY EDUCATION

### Master of Education

The Master of Education in Elementary Education includes coursework in psychological and sociological foundations, curriculum development, pedagogy, specialized content, and research. The program is intended to strengthen and enhance teaching skills, promote research and reflection on innovative teaching strategies, and expand content knowledge. By examining and reflecting on best practices, students have the opportunity to improve the qualities that make them effective teachers who respond to the emotional, motivational, cognitive, and cultural needs of all students. The use of multiple teaching strategies, lively class discussion, and active student involvement supports learning for all students.

### Admission Requirements

A complete application package should include a bachelor's degree, a valid teaching certificate, two letters of recommendation, an undergraduate transcript with a grade-point ratio of 3.0 on a 4.0 scale (last 60 hours), and acceptable GRE scores.

Before enrolling in any graduate course, the student should arrange a conference with the major advisor. Courses taken prior to this conference may not be acceptable for the degree. Professional development courses will not count toward the degree. Exceptions to the program of study must be approved by the student's advisory committee consisting of the major advisor and two faculty members from the department in which the student has taken coursework.

### Degree Requirements

Graduate students must satisfy requirements for the Graduate School, complete the approved program of study for the degree, maintain a B average in all graduate work, and pass a comprehensive exam. The degree requires 36 credit hours.



When the student has successfully completed 27 credit hours toward the degree, he/she may take the comprehensive examination. The examination will be written and arranged at a specified time each semester.

*Psychological and Sociological Foundations*—Six credits selected from ED L 715 or (ED F) 800; ED F 701 or 702

*Curriculum Development*—ED EL 760, 804

*Specialized Content*—ED SP 823, READ 865

*Research*—ED F 778, 808

*Option*—Twelve credit hours as follows:

*Elementary Option*—Six to nine credit hours of coursework related to the specific content/subject matter taught in the elementary school; and three–six credit hours of coursework related to classroom practices, teaching methods, and instructional techniques

*Mathematics and Science Option*—12 credit hours of coursework related to specific mathematics and science content taught in the elementary school

*Language Arts Option*—12 credit hours of coursework related to specific language arts content taught in the elementary school

## HUMAN RESOURCE DEVELOPMENT

### Master of Human Resource Development

The human resource field is a specialized blend of education, counseling, psychology, management, and sociology. The Master of Human Resource Development (MHRD) prepares industrial training directors, educational specialists, training coordinators, and personnel for HRD occupations in business, industry, and the public sector.

HRD specialists commonly provide training related to the areas of technical and interpersonal skills, management, and motivation. The HRD program is designed to involve and enhance a variety of professional management activities. The program serves professionals working in the areas of manufacturing, construction, health occupations, secretarial sciences, graphic communications, transportation, loss control, quality control, information services, and personnel management.

Graduates of the program are capable of utilizing contemporary instructional technologies and methodologies. Program participants gain valuable skills and knowledge related to the varied roles of the training specialist.

Applicants to the MHRD program are reviewed on undergraduate coursework, academic performance, and employment experience. The program requires 36 credit hours including 15 hours in core human resource development courses, six hours in research methods, and 15 hours in coursework appropriate to individual career objectives, such as personnel management, organizational development, career counseling, compensation management, etc.

This program is also available to off-campus students through the Office of Off-Campus, Distance, and Continuing Education (1-888-253-6766).

#### Admission Requirements

Complete application package should include either 24 credit hours of undergraduate credit related to HRD or equivalent work experience (may be satisfied through appropriate corequisites), an undergraduate grade-point ratio of 3.0 on a 4.0 scale, acceptable GRE scores, and departmental approval.

#### Program Requirements

The program in Human Resource Development requires the following coursework:

*Application*—six to nine credit hours selected from CTE 820, 865, 895, ED F (AG ED, THRD) 680, (AG ED, THRD) 682, H R D (CTE) 846, (CTE) 870, THRD 610, VT ED 876

*Applied Research*—six credit hours: AG ED (CTE, ED) 889 and H R D 897

*Cognate Theory*—six to nine credit hours selected from AG ED 801, 821, APEC 824, ECON (APEC) 816, ED C 810, 811, 812, 813, 815, 822, ED F 808, ED L (VT ED) 955, ENGL 690, 850, 853, 854, EX ST 611, 801, 802, MGT (M B A) 809, 815, 818, (M B A) 874, 904, PRTM 705, PSYCH 659, 860, 862, 863, SOC 803, 805, 830

*Foundations/Training*—15 credit hours: H R D 830, (CTE) 845, (CTE) 847, 849, and (CTE) 860

## MIDDLE GRADES EDUCATION

### Master of Arts in Teaching

The Master of Arts in Teaching degree is designed for mid-career professionals who are seeking to change fields and for students with backgrounds in content areas who are not currently certified to teach. The program in Middle Grades Education possesses several intrinsic advantages over other initial certification programs. Most importantly, it places well-prepared candidates in the classroom in a timely manner. An individual possessing a bachelor's degree in a content or closely related field is given an intensive one-year field-based experience. He/she can then expect to start in the classroom as a first year teacher after a full academic year (including summer sessions).

#### Objectives

The objectives of the Master of Arts in Teaching in Middle Grades Education are to promote the entrance of content-ready individuals into the South Carolina classroom in a timely manner and to provide a rigorous yet plausible route for individuals seeking to change careers and enter teaching.

#### Admission Requirements

Candidates are accepted based on a combination of test scores, interviews, and academic record. Applicants are expected to take the Praxis II exams in the two content areas in which they plan to receive certification. They are required to have passed one of these Praxis II exams to be admitted to the program.

#### Program Requirements

The MAT program is offered at the University Center of Greenville. It is composed of three elements: core pedagogical coursework, content coursework, and an intensive field-based component. Core courses are taken by cohort students in a block—two during second summer session, three in the fall, and three in the spring. This includes six hours of Methods Practicum, three in each area of content certification. These six credit hours meet the State's requirements for student teaching. The remaining 12 credit hours are taken individually in the content areas.

Students in the MAT block begin during the fall semester when public schools begin. They spend the full day in the schools.

In the spring, students begin the semester with two weeks of intensive classroom work in the three remaining core courses. These courses are considered "bookend" classes that bracket the student teaching experience. The methods practicum/student teaching includes a portfolio assignment.

The MAT in Middle Grades Education program requires 36 credit hours of coursework, arranged as follows:

*Summer Session I Block Courses*—ED F 701, 702

*Summer Session II Block Courses*—content courses at the master's level approved by advisor

*Fall Semester Block Courses*—ED 641, 738, ED F 808

*Spring Semester Block Courses*—ED 738, ED SP 823, READ 867

*Content Area Courses*—12 credit hours scheduled by the student and advisor

## READING

### Master of Education

The purpose of an MEd degree in Reading is to educate reading professionals who have an in-depth knowledge of reading theories, processes, strategies, curriculum, and research and who can use that knowledge to plan appropriate reading programs and curricula for a variety of contexts and communicate information to a wide variety of audiences.

#### Objectives

Graduates with the MEd in Reading will demonstrate (1) an understanding of reading as the process of constructing meaning through the interaction of the reader's existing knowledge, the information suggested by the written language, and the context of the reading situation; (2) knowledge of the influence of cultural, ethnic, and linguistic backgrounds on the reading process and how to use what the reader brings to the reading experience; (3) an understanding of relationships among the language processes of reading, writing, listening, and speaking; (4) support for students in acquiring the ability to monitor comprehension and reading processes and apply appropriate strategies for a variety of purposes; (5) knowledge of assessments that involve multiple indicators of learner progress; (6) development of an environment that motivates students to pursue and respond to reading and writing for personal growth and development; (7) class-



room-based research in reading; and (8) expertise in sharing knowledge of reading research and instructional practices with peers.

#### Admission Requirements

A complete application package should include a bachelor's degree, a valid teaching certificate, two letters of recommendation, an undergraduate transcript with a grade-point ratio of 3.0 on a 4.0 scale (last 60 hours), acceptable GRE scores, and a statement of purpose (professional goals and philosophy of teaching).

#### Program Requirements

The program requires 36 credit hours of coursework and a satisfactory score on the comprehensive exam. The following courses are required of all students: EDF 702, 808, READ 860, 861, 862, 863, 864, 865, 866.

The MEd in Reading offers four plans for completion of course requirements:

*Reading Teacher and Reading Consultant Certifications*—In addition to the required core courses above, students must take nine additional credit hours of reading/language arts courses selected from EDF 880, ED SP 820, ENGL 700, READ 867, 868, 869, 870, 871, 872, 873, 882, 883. ED 837 or 838 may also be taken for additional credit.

*Reading Teacher and Reading Consultant Certifications plus Reading Recovery Training*—(Three years teaching experience are recommended as training prerequisite.) In addition to the required courses above, students are required to take READ 880, 881, and three additional credit hours selected from EDF 880, ED SP 820, ENGL 700, READ 867, 868, 869, 870, 871, 872, 873, 882, 883. ED 837 or 838 may also be taken for additional credit.

*Reading Teacher, Reading Consultant, and Reading Coordinator/Director Certifications*—In addition to the required courses above, students are required to take nine credit hours arranged as follows: three hours selected from ED C 801, 811, 812; three hours selected from ED EL 760, EDSEC 765; three hours selected from ED L 705, 720, 730, 735.

*Early Literacy Emphasis with Reading Teacher and Reading Consultant Certifications*—In addition to the required courses above, students are required to take nine additional credit hours selected from READ 870, 871, 872, 873.

## SECONDARY EDUCATION

### Master of Education

The purpose of an MEd degree in Secondary Education is to assist secondary teachers in increasing competence in both subject content and instruction; therefore, the program has practical and theoretical work in education as well as appropriate content in the subject area.

The student's advisor depends upon the content specialty area: English language, mathematics, natural sciences, and social studies. Before enrolling in any graduate course, the student shall arrange a conference with the major advisor. Courses taken prior to this conference may not be acceptable for the degree. The advisory committee will consist of the major advisor, a faculty member chosen from the

appropriate content teaching area department from whom the student has taken coursework, and a third member at-large (typically one from whom courses are taken). When the student has successfully completed the examination, the committee will recommend that the degree be granted. The examination will be written and arranged at a specified time each semester.

#### Admission Requirements

A complete application package should include a bachelor's degree, a valid teaching certificate, two letters of recommendation, an undergraduate transcript with a grade-point ratio of 3.0 on a 4.0 scale (last 60 hours), and acceptable GRE scores.

#### Degree Requirements

The Secondary Education program requires a minimum of 36 credit hours in graduate courses with a grade-point ratio 3.0 or higher, of which at least 18 hours must be from courses at the 700-level or above.

A written exit examination is required by Teacher Education. All coursework to be credited must have been enrolled in and completed within six calendar years prior to the date on which the degree is to be awarded. This includes up to 12 hours of approved graduate work that may be transferred from another institution.

Specific course requirements follow:

*Education Courses*—15–18 credit hours: ED 860, EDF 778, 808, EDSEC 765, 803, READ 864. (Students who have successfully completed an undergraduate content reading course are not required to take READ 864.)

*Content Courses*—A minimum of 18 hours of content courses at the 600, 700, or 800 level, approved by the advisory committee, will be completed in English, mathematics, natural sciences, or social studies. Students must complete EDSEC 841, 842, 843, or 844. Students in mathematics must also complete EDSEC 637 unless a similar undergraduate course was completed. Appropriate courses in emphasis areas include the following:

*English*—composition, literature, drama, theatre, communication studies, visual arts, technical writing, graphic communications

*Mathematics*—mathematics, experimental statistics, computer science

*Natural Sciences*—astronomy, biology, botany, chemistry, crop and soil environmental science, entomology, environmental sciences, genetics, geology, microbiology, physics, zoology, and selected courses in animal and veterinary sciences, food science, health science, horticulture, plant pathology, wildlife and fisheries biology

*Social Studies*—cultural studies, economics, geography, history, political science, psychology, sociology

*Electives*—To complete the 36 credit hours required, students may enroll in an approved elective. Recommended electives include ED 837, 838, EDF (AG ED, THRD) 680, (AG ED, THRD) 682, 690, 701, 702, 870, 872, ED L (ED F) 800. The advisory committee may approve electives not listed above.

## SPECIAL EDUCATION

### Master of Education

The Master of Education degree in Special Education ensures that students are knowledgeable in the field of special education. The program in Special Education prepares students in one of the following areas: emotional/behavioral disorders, learning disabilities, or mental retardation. The program is approved by the Council for Exceptional Children (CEC) and follows guidelines prescribed by CEC. The prescribed program of study enables students to identify important legal and policy issues in special education, demonstrate knowledge of the research processes within the field of special education, demonstrate knowledge of specific characteristics of individuals with mild disabilities, and implement research-validated interventions for students with disabilities in a variety of settings. Successful graduates will evaluate critically the literature in the field, recognize and evaluate current issues and problems in special education, and identify potential solutions for these problems.

Graduate students must satisfy requirements of the Graduate School, complete the approved program of study for the degree, maintain a B average in all graduate work and pass a comprehensive exam. The degree requires 36 credit hours.

#### Admission Requirements

A complete application package should include a bachelor's degree, a valid teaching certificate, two letters of recommendation, an undergraduate transcript with a grade-point ratio of 3.0 on a 4.0 scale (last 60 hours), and acceptable GRE scores.

#### Program Requirements

*Required Courses*—ED F 778, ED SP 820, 821, 823, 840, 853, 854, READ 865

*South Carolina Certification Area*—The student is expected, along with his/her major advisor, to plan master's coursework (nine credit hours) in conjunction with the current State Department list of required courses for particular endorsements. To be eligible for a South Carolina endorsement in Emotional Disabilities, Learning Disabilities, and/or Mental Disabilities, the student must take the corresponding PRAXIS Core and Specialty Area examinations. The student must complete one of the following sequences for an MEd in Special Education:

*Emotional Disorders Emphasis*—The following courses are recommended: ED SP 669, 674, 675, 678.

*Learning Disabilities Emphasis*—The following courses are recommended: ED SP 670, 675, 676.

*Mental Retardation Emphasis*—The following courses are recommended: ED SP 672, 673, 679.

*Electives*—Three credit hours are required. ED SP 822 is recommended for those intending to work in elementary settings. ED SP 841 is recommended for those intending to work in secondary settings. Additional electives may be selected from the following: ED (ED F, ED SP) 894, ED SP 738, 739, 822, 841, PRTM (ED SP) 614, or other courses approved by the advisory committee.



## YOUTH DEVELOPMENT

### Master of Science

The Master of Science in Youth Development degree program is designed to equip students with the competencies, knowledge, and skills to help young people develop into healthy, competent, coping, and contributing citizens. This program prepares students to address issues facing youth in the context of family and community with an emphasis on positive outcomes through a dynamic learning environment.

The MS in Youth Development program is an interdisciplinary degree primarily involving departments and units in the College of Health, Education, and Human Development but also including academic areas from other colleges and units at the University. This program is designed to meet the needs of students who are also working professionals. All courses are offered in an accelerated format and are delivered through a variety of asynchronous and synchronous distance education technologies. Minimum technology requirements for this program include access to e-mail and the Internet with the ability to read CD-ROMs and DVDs.

This program has a strong relationship with youth-related agencies/organizations and engages them in learning and experiential opportunities for students. The Youth Development program is designed to 1) empower students to focus on strengths and assets within the context of family and community that will promote positive youth development; 2) identify and examine physical, emotional, environmental, and social issues related to being a young person in today's society; 3) prepare professional educators and leaders at all program and management levels for careers in schools, agencies, institutions, and community groups that serve youth; 4) train new and current professionals to be well prepared with increased knowledge and enhanced skills in the youth development area; 5) prepare leaders who will have an immediate impact on youth development in South Carolina and around the nation; 6) link formal and non-formal prevention and intervention youth programs to enhance the learning experience for students; and 7) enhance youth serving agencies and organizations by supplying professionals who are competent in child and adolescent growth and development.

The Master of Science in Youth Development requires 36 semester hours of coursework as follows: EX ST 801, HEHD 800, 801, 802, 803, 804, 805, 806, 807, 808, 892, SOC 805.

#### Admission Requirements

A complete application packet should include proof of a baccalaureate degree with a minimum grade-point ratio of 3.0 on a 4.0 scale, an acceptable score on the Graduate Record Examination (GRE), a letter of intent, and two letters of reference. Experience in the field of youth development is preferred.

## NURSING

### Master of Science

The Master of Science degree program with a major in Nursing builds upon the first professional degree. The student acquires knowledge and skills in advanced nursing: clinical nurse specialist (CNS), nurse practitioner (NP), nurse administration, or nursing education. The student may select one of the following study options: child/adolescent nursing (CNS), adult/gerontological nursing (CNS), adult/gerontological nurse practitioner (ANP), family nurse practitioner (FNP), gerontological nurse practitioner (GNP), nurse administration, or nursing education. All graduate options articulate with the baccalaureate program in the continued acquisition of advanced nursing knowledge and skills. This specialization builds toward advanced nursing knowledge in selected practice and role areas. Theory, research, and role development are emphasized to enable the graduate to participate in the development of nursing knowledge and contribute to the advancement of the nursing profession.

The objectives of the Master of Science degree program in Nursing are to provide graduates with the ability to (1) integrate advanced knowledge from nursing and related disciplines into a specialized area of nursing practice; (2) demonstrate competence in a selected functional role (clinical specialist, nurse practitioner, nurse administrator, or nurse educator); (3) evaluate and apply research findings from nursing and related disciplines to advanced nursing practice; (4) participate in the development of nursing knowledge by identifying researchable nursing problems, conducting research, and selectively integrating research findings in advanced nursing practice; (5) utilize leadership, management, teaching knowledge, and competence to influence nursing practice; (6) participate as a leader to influence health policy and improve the health care delivery system; and (7) contribute to the advancement of the nursing profession.

All graduate courses are based at the University Center of Greenville.

#### Admission Requirements

In addition to meeting University admission requirements, applicants should be graduates of nationally accredited baccalaureate nursing programs; must have had an undergraduate statistics course, computer course, or equivalent; and demonstrate evidence of current basic client assessment skills. In addition, students must document recent significant nursing practice which is defined as 600 hours during the 12 months prior to acceptance into the program. Nursing Administration majors must complete an undergraduate accounting course.

## PARKS, RECREATION, AND TOURISM MANAGEMENT

### Master of Parks, Recreation, and Tourism Management

#### Master of Science

#### Doctor of Philosophy

The department offers a professional master's degree (MPRTM), a Master of Science degree (MS), and a Doctor of Philosophy degree (PhD). Flexibility permits individual development in professional interest areas such as therapeutic recreation; travel and tourism management; park and protected area management and interpretation; and administration of recreation, park, or tourism systems. Each student's program is tailored to suit his/her personal and professional goals. Applicants from nonrecreation disciplines are required to develop background knowledge of recreation through undergraduate coursework. All applicants must submit GRE scores.

The Master of Parks, Recreation, and Tourism Management should be selected by individuals who intend to enter or reenter the workplace upon completion of degree requirements. Applicants for the MPRTM degree who document at least three years of relevant professional experience beyond a bachelor's degree in recreation and a 3.0 undergraduate grade-point ratio are not required to submit GRE scores for admission. Each candidate completes an independent project to meet degree requirements. A minimum of 36 hours of coursework is required.

The Master of Science is a research degree with a research thesis requirement. This degree is designed for individuals planning to undertake doctoral study or seek employment in a research-related position. Candidates must complete a minimum of 30 hours of coursework and six hours of research culminating in a thesis.

The Doctor of Philosophy is an advanced research degree requiring performance of original research leading to a dissertation. Comprehensive and final examinations and 18 hours of dissertation research are required. Coursework is determined by each student's doctoral committee.



# COURSES OF INSTRUCTION

This list includes for each course the catalog number, title, credit hours, class and laboratory hours per week, description, and prerequisites.

A secondary listing in parentheses indicates that this course is cross-listed with another program.

Graduate credit may be earned only for courses numbered 600 or above. Each 600-level course carries a 400-level undergraduate counterpart. Students who receive graduate credit in such courses must do extra work of an appropriate nature as determined by the department and are graded according to graduate standards. Students who receive credit for the 400-level course may not receive credit later for the same course at the 600 level.

Courses at the 700 level are designed primarily for the degrees that emphasize professional practice rather than research.

## COURSE ABBREVIATIONS

Accounting .....	ACCT
Aerospace Studies .....	A S
African American Studies .....	A A S
Agricultural and Applied Economics .....	AP EC
Agricultural Education .....	AG ED
Agricultural Mechanization .....	AG M
Agriculture .....	AGRIC
Agriculture, Forestry, and Life Sciences .....	AFLS
American Sign Language .....	A S L
Animal and Veterinary Sciences .....	AVS
Animal Physiology .....	AN PH
Anthropology .....	ANTH
Architecture .....	ARCH
Art .....	ART
Art and Architectural History .....	A A H
Astronomy .....	ASTR
Athletic Leadership .....	A L
Biochemistry .....	BIOCH
Bioengineering .....	BIO E
Biological Sciences .....	BIO SC
Biology .....	BIOL
Biosystems Engineering .....	B E
Botany .....	BOT
Business .....	BUS
Business Administration .....	M B A
Calhoun Honors Seminar .....	C H S
Career and Technology Education .....	CTE
Ceramic and Materials Engineering .....	C M E
Chemical Engineering .....	CH E
Chemistry .....	CH
Chinese .....	CHIN
City and Regional Planning .....	C R P
Civil Engineering .....	C E
Clemson University .....	C U
College of Engineering and Science .....	CES
Communication Studies .....	COMM
Community and Rural Development .....	C R D
Computer Science .....	CP SC
Construction Science and Management .....	C S M
Crop and Soil Environmental Science .....	CSENV
Dance .....	DANCE
Design Studies .....	DSIGN
Early Childhood Education .....	ED EC
East Asian Studies .....	E A S

Economics .....	ECON
Education .....	ED
Educational Counseling .....	ED C
Educational Foundations .....	ED F
Educational Leadership .....	ED L
Electrical and Computer Engineering .....	E C E
Elementary Education .....	ED EL
Engineering .....	ENGR
Engineering Graphics .....	E G
Engineering Mechanics .....	E M
English .....	ENGL
Entomology .....	ENT
Environmental and Natural Resources .....	E N R
Environmental Design and Planning .....	EDP
Environmental Engineering and Science .....	EE&S
Environmental Science and Policy .....	EN SP
Environmental Toxicology .....	ENTOX
Executive Leadership and Entrepreneurship .....	E L E
Experimental Statistics .....	EX ST
Family and Community Studies .....	FCS
Finance .....	FIN
Food Science .....	FD SC
Food Technology .....	FD TH
Forest and Recreation Resources .....	F&RR
Forestry .....	FOR
Forestry and Natural Resources .....	F N R
French .....	FR
Genetics .....	GEN
Geography .....	GEOG
Geology .....	GEOL
German .....	GER
Government and International Trade .....	GINT
Graduate Studies .....	G S
Graphic Communications .....	G C
Great Works .....	G W
Health .....	HLTH
Health Administration .....	M H A
Health, Education, and Human Development .....	HEHD
Historic Preservation .....	H P
History .....	HIST
Horticulture .....	HORT
Human Resource Development .....	H R D
Humanities .....	HUM
Industrial Engineering .....	I E
Integrated Pest Management .....	I P M
Italian .....	ITAL
Japanese .....	JAPN
Landscape Architecture .....	LARCH
Language .....	LANG
Language and International Trade .....	L&IT
Latin .....	LATIN
Law .....	LAW
Leisure Skills .....	L S
Management .....	MGT
Marketing .....	MKT
Materials Science and Engineering .....	MS&E
Mathematical Sciences .....	MTHSC
Mechanical Engineering .....	M E
Microbiology .....	MICRO
Military Leadership .....	M L
Music .....	MUSIC
Nonprofit Leadership .....	NPL
Nursing .....	NURS
Nutrition .....	NUTR
Packaging Science .....	PKGSC
Parks, Recreation, and Tourism Management .....	PRTM

Performing Arts .....	P A
Philosophy .....	PHIL
Physical Science .....	PH SC
Physics .....	PHYS
Plant and Environmental Sciences .....	PES
Plant Pathology .....	PL PA
Plant Physiology .....	PL PH
Policy Studies .....	PO ST
Political Science .....	PO SC
Polymer and Textile Chemistry .....	PTC
Portuguese .....	PORT
Psychology .....	PSYCH
Reading .....	READ
Real Estate Development .....	RED
Religion .....	REL
Rural Sociology .....	R S
Russian .....	RUSS
Secondary Education .....	EDSEC
Sociology .....	SOC
Spanish .....	SPAN
Special Education .....	ED SP
Technology and Human Resource Development .....	THRD
Textiles .....	TEXT
Theatre .....	THEA
Transition to Teaching .....	TTT
Vocational-Technical Education .....	VT ED
Wildlife and Fisheries Biology .....	W F B
Women's Studies .....	W S
Zoology .....	ZOOL

## ACCOUNTING

**ACCT 604 Individual Taxation 3(3,0)** Interpretation of federal income tax laws, regulations, and court decisions with practice in application of these laws to the returns of individuals, partnerships, and corporations. *Preq:* ACCT 311 with a C or better.

**ACCT 801 Financial Accounting Theory and Research 3(3,0)** Evolution of financial accounting theory and its application to contemporary reporting. Emphasis is on learning to research, document, and present a rationale for a recommended alternative. Research problems are derived from actual audit disputes concerning financial presentation. *Preq:* ACCT 313 or equivalent.

**ACCT 802 Auditing Seminar 3(3,0)** Professional Standard for independent auditors. Taught by the case method; includes a discussion of contemporary auditing problems and cases. *Preq:* ACCT 415 or equivalent.

**ACCT 803 Accounting Information Systems 3(3,0)** Accounting systems including database concepts, systems design and evaluation, systems controls, and systems implementation. *Preq:* ACCT 303, 313, and 322; or equivalent.

**ACCT 804 The Environment of Accounting 3(3,0)** Professional, legislative, judicial, and social environments in which the accounting profession operates. *Preq:* ACCT 415 or equivalent.

**ACCT 806 Advanced Accounting Problems 3(3,0)** Specialized aspects of financial accounting including business combinations accounting and reporting practices of regulated and nonregulated industries, emerging practices and developments in financial accounting, fund accounting, and corporate reorganizations and liquidations. *Preq:* ACCT 313 or equivalent.



**ACCT 814 Taxation of Business Entities 3(3,0)**

Discusses the interrelationship of taxation and business decisions. Designed for students not specializing in taxation. *Preq:* ACCT 404 or equivalent.

**ACCT 815 Federal and State Income Taxation of Corporations 3(3,0)**

Tax principles and concepts involved in corporate-shareholder transactions, tax planning of corporations, Subchapter C, and related provisions of the Internal Revenue Code. *Preq:* ACCT 404 or equivalent.

**ACCT 816 Taxation of Estates, Gifts, and Fiduciaries 3(3,0)**

Federal estate and gift tax laws; federal income tax laws related to trusts and estates. *Preq:* ACCT 404 or equivalent.

**ACCT 817 Tax Research 3(3,0)**

Tax research methodology as applied to the solution of routine and complex tax problems emphasizing the methodology of solution rather than a specific tax area. *Preq:* ACCT 404 or equivalent.

**ACCT 818 Taxation of Partnerships 3(3,0)**

Tax principles and concepts involved in partnership transactions, tax planning, and tax shelters. *Preq:* ACCT 404 or equivalent.

**ACCT 819 Current and Special Topics in Taxation 3(3,0)**

Specialized and contemporary topics in federal taxation and tax practice. *Preq:* ACCT 404 or equivalent.

**ACCT 820 Advanced Topics and Planning in Taxation 3(3,0)**

Planning element for federal and state taxes in business decisions including current sophisticated developments in taxation. *Preq:* ACCT 404 or equivalent.

**ACCT 821 Controllorship 3(3,0)**

Advanced internal accounting emphasizing accounting implications for management decision making. *Preq:* ACCT 303 or equivalent.

**ACCT 845 Operational Auditing Seminar 3(3,0)**

Management control and operational systems; opportunities for improvement and development of practical and cost effective solutions to managerial problems using selected readings from case studies and industry monographs provided by the Institute of Internal Auditing. *Preq:* ACCT 340 or 415 or consent of instructor.

**ACCT 899 Professional Exam Review 0(0,0)**

Preparation for professional examination of the student's choice: the Certified Public Accountant, Certified Management Accountant, or Certified Internal Auditor exam. Must be completed prior to receiving MPAcc degree. Does not contribute hours toward degree completion. To be taken Pass/Fail only.

**AFRICAN AMERICAN STUDIES****A A S 698 Seminar on African American Studies 3(3,0)**

Research/writing seminar on the African American experience. Selected topics and themes from 1900 to present. *Preq:* A A S 301, HIST 311, 312, or 339.

**AGRICULTURAL AND APPLIED ECONOMICS****AP EC 602 Production Economics 3(3,0)**

Economic analysis of agricultural production involving the concept of the farm as a firm, principles for decision making, the quantitative nature and use of production and cost functions and their interrelations, and application of these principles to resource allocation in farms and among areas. Offered fall semester only. *Preq:* AP EC 308, ECON 314.

**AP EC 603 Land Economics 3(3,0)**

Study of the characteristics of land and of the physical, legal, social, and economic principles and problems relating to the control and use of land resources. Offered spring semester only. *Preq:* AP EC 202 or ECON 200.

**AP EC 609 Commodity Futures Markets 3(3,0)**

Introduction to the economic theory, organization, and operating principles of agricultural commodity futures markets in the United States. Emphasis is placed on speculating, hedging, and investing in agricultural commodity futures contracts from the standpoint of the agribusiness entrepreneur. *Preq:* AP EC 202 or ECON 211.

**AP EC (C R D) 611 Regional Impact Analysis 3(3,0)**

See C R D 611.

**AP EC (C R D) 612 Regional Economic Development Theory and Policy 3(3,0)**

See C R D 612.

**AP EC 613 Advanced Real Estate Appraisal 3(3,0)**

Topics include highest and best use analysis, data collection and analyses. Advanced appraisal procedures for income, cost, and comparable sales approach to real estate valuation are stressed. Eminent domain, the appraisal of property in transition, and specialized property are covered. Offered spring semester only. *Preq:* AP EC 313, FIN 307, or consent of instructor.

**AP EC 620 World Agricultural Trade 3(3,0)**

Practical considerations of agricultural trade and trade policy analysis are reviewed. The role of international institutions is considered. Special emphasis is placed on concepts of agricultural trade, analysis of trade policies of major trading partners/competitors, and export/import marketing of products. Offered spring semester only. *Preq:* AP EC 309, ECON 412, or consent of instructor.

**AP EC 621 Globalization 3(3,0)**

Utilizes basic principles of international economics (comparative advantage, free trade vs. protectionism, exchange rate determination, etc.) to analyze the contemporary problems and issues of the world economy. Emphasizes application of economic principles to current globalization trends. *Preq:* ECON 310 or 412 or 413 or consent of instructor.

**AP EC (CSENV) 626 Cropping Systems Analysis 3(2,2)**

See CSENV 626.

**AP EC 633 Agricultural Law and Related Environmental Issues 3(3,0)**

Introduction to agricultural and agricultural-related environmental legal issues. Topics include a review of laws, agencies, programs, court structure, torts, taxation, biotechnology, land and water use, regulated industry, and environment liabilities as they relate to agriculture and natural resources. Offered spring semester only. *Preq:* LAW 322 or consent of instructor.

**AP EC 652 Agricultural Policy 3(3,0)** Review of public agricultural policy programs in the United States and a critical examination of current and proposed government policies and programs affecting the agricultural sector of the economy. Economic considerations as related to past and current farm price and income problems are included. Offered spring semester only. *Preq:* AP EC 302, 309.

**AP EC 656 Prices 3(3,0)** Review of the basic theory of price under competitive conditions and various modifications; nature, measurement, and causes of daily, seasonal, and cyclical price fluctuations; geographical price relationships; nature, function, and behavior of futures markets; government price programs. Offered spring semester only. *Preq:* AP EC 308, ECON 314, EX ST 462.

**AP EC 657 Natural Resource Economic Theory and Policy 3(3,0)** Focuses on analysis of actual, efficient, and sustainable use of natural resources. Topics may vary but include land-use change and regulation, water use and marketing, harvesting trees or fish on farms, harvesting and developing property rights to open-access resources, renewable versus nonrenewable energy use, and sustainable development. *Preq:* MTHSC 102; C R D 357 or ECON 314.

**AP EC 658 Economics of Risk Management 3(3,0)** Focuses on cost-benefit analysis of risks, incorporation of economic considerations into risk assessments, and microeconomic analysis of activities, insurance, and policies that reduce, mitigate, or increase these risks. Possible topics include climate change, wildland fire, erosion, pests and invasive species, pestilence, food contamination, and hurricanes. *Preq:* MTHSC 102 and C R D 357 or ECON 314.

**AP EC 660 Agricultural Finance 3(3,0)** Study of the principles and technique of financing in the agricultural sector. Topics include the capital situation in agriculture, concepts of farm financial management, use of credit, capital markets, lending agencies, and estate planning. Offered spring semester only. *Preq:* ACCT 201, AP EC 202.

**AP EC 675 Economics of Wildlife Management and Policy 3(3,0)** Integrated approach to the study of the economics of wildlife. Topics include determination of market and nonmarket value, single and multiple species management, enterprise cost and returns, marketing wildlife, leasing methods, complementarity and competitiveness with agricultural and forestry enterprises, and timber and crop damage cost estimates and control. *Preq:* AP EC 202, ECON 200, FOR 304, W F B 306, or consent of instructor.

**AP EC (ECON) 800 History of Economic Thought 3(3,0)** See ECON 800.

**AP EC (ECON) 801 Microeconomic Theory 3(3,0)** See ECON 801.

**AP EC (ECON) 802 Advanced Economic Concepts and Applications 3(3,0)** See ECON 802.

**AP EC (ECON) 804 Applied Mathematical Economics 3(3,0)** Mathematical tools needed in economic analysis; matrix algebra, differentiation, unconstrained and constrained optimization, integration and linear programming.



**AP EC (ECON) 806 Econometrics I 3(3,0)** Application of econometric techniques and stochastic models to economic problems; distribution theory, simple and multiple regression modeling, hypothesis testing, and other issues in regression analysis.

**AP EC (ECON) 807 Econometrics II 3(3,0)** See ECON 807.

**AP EC (ECON) 808 Econometrics III 3(3,0)** See ECON 808.

**AP EC (ECON) 809 Advanced Natural Resource Economics 3(3,0)** Applications of economic theory to problems of natural resource management, epistemological considerations, rent theory, public and private investment criteria, benefit-cost analysis, and general equilibrium management models. Offered spring semester only. *Preq:* ECON (AP EC) 802 or consent of instructor.

**AP EC (ECON) 810 Natural Resources Management and Policy 3(3,0)** Economic, institutional, and legal aspects of control and management of natural resources; concepts of economic science applied to public policy questions related to land and water resources. Specialized background in economics not necessary. Offered fall semester only. *Preq:* Consent of instructor.

**AP EC (ECON) 811 Economics of Environmental Quality 3(3,0)** See ECON 811.

**AP EC (ECON) 816 Labor Economics 3(3,0)** See ECON 816.

**AP EC (ECON) 817 Advanced Production Economics 3(3,0)** Production economics theory in a quantitative framework; technical and economic factor-product, factor-factor, and product-product relationships in single- and multi-product firms under conditions of perfect and imperfect competition in both factor and product markets. Offered spring semester only. *Preq:* AP EC (ECON) 804 or consent of instructor.

**AP EC 819 Futures and Options Markets 3(3,0)** Introduction to the economic theory and operation of futures and options markets in the United States; determination of prices and price differences, speculation, and the use of these markets for forward pricing and price risk management. *Preq:* Consent of instructor.

**AP EC (ECON) 820 Public Finance 3(3,0)** See ECON 820.

**AP EC (ECON) 822 Contemporary Public Policy 3(3,0)** Contemporary public policy, including price and resource policy, affecting rural areas; public participation, or the lack thereof, related to programs designed to implement public policy. Offered spring semester only.

**AP EC (ECON) 824 Organization of Industry 3(3,0)** See ECON 824.

**AP EC (ECON) 826 Economic Theory of Government Regulation 3(3,0)** See ECON 826.

**AP EC (ECON) 827 Economics of Property Rights 3(3,0)** See ECON 827.

**AP EC (ECON) 828 Market Structure in Agricultural Industries 3(3,0)** Market structure and other approaches related to agricultural marketing. Individual assignments in the student's field of interest required. *Preq:* Consent of instructor.

**AP EC (ECON) 831 Economic Development 3(3,0)** See ECON 831.

**AP EC (ECON) 832 Community and Regional Economics 3(3,0)** Economic theory and research methods needed to understand happenings in the regional and community economy and how local and non-local decisions influence local economic change. Offered fall semester only. *Preq:* C R D (AP EC) 612 or consent of instructor.

**AP EC (ECON) 840 International Trade Theory 3(3,0)** See ECON 840.

**AP EC (ECON) 841 International Finance 3(3,0)** See ECON 841.

**AP EC 852 Research Methods for Agricultural Economists I 2(2,0)** Linear models and their application to problems related to the economics of agriculture; simplex method, developing farm planning LP models, solving LP problems using the MPSX computer program, parametric analysis techniques, and other LP applications related to rural problems. Offered spring semester only.

**AP EC (ECON) 855 Financial Economics 3(3,0)** See ECON 855.

**AP EC 881 Internship in Community and Resource Development 1-6** Supervised employment in an agency dealing with socioeconomic aspects, community development, and/or natural resource management; monthly reports covering student's experience are required. *Preq:* 18 semester hours of graduate credit.

**AP EC (ECON) 888 Directed Reading in Economics 1-3(1-3,0)** See ECON 888.

**AP EC 891 Master's Thesis Research 1-12**

**AP EC (ECON) 899 Selected Topics 1-3(1-3,0)** Selected topics under guidance of a professor. May be repeated for a maximum of six credits.

**AP EC (ECON) 901 Price Theory 3(3,0)** See ECON 901.

**AP EC (ECON) 903 General Equilibrium and Welfare Theory 3(3,0)** Second in a two-course sequence in advanced price theory. First part covers the development of the theory of general equilibrium and the economics of welfare; the second covers the capital theory and the determination of the rate of interest. Offered spring only. *Preq:* ECON (AP EC) 901.

**AP EC (ECON) 904 Seminar in Resource Economics 3(3,0)** Special problems and recent periodical literature relating to the control, management, development, and use of land and water resources in the U.S. and in other parts of the world. Offered fall semester only. *Preq:* AP EC 603.

**AP EC (ECON) 905 Advanced Macroeconomic Issues 3(3,0)** See ECON 905.

**AP EC (ECON) 906 Seminar in Area Economic Development 3(3,0)** Consideration of recent research developments in economic development. Includes a review of research publications, journal articles, and other literature. Objectives, analytical techniques, and procedures are used in area or regional development efforts. Offered spring semester only. *Preq:* AP EC (ECON) 806.

**AP EC (ECON) 917 Advanced Seminar in Labor Economics 3(3,0)** See ECON 917.

**AP EC (ECON) 950 Monetary Economics 3(3,0)** See ECON 950.

**AP EC (ECON) 991 Doctoral Dissertation Research 1-12**

## AGRICULTURAL EDUCATION

**AG ED 601 Instructional Methods in Agricultural Education 3(2,3)** Appropriate methods of teaching vocational agriculture in high schools. Includes procedures for organizing teaching programs, teaching high school students, and directing FFA activities.

**AG ED 603 Principles of Adult/Extension Education 3(3,0)** Overview of adult/extension education and adult learning. Selection of adult education providers is reviewed with emphasis on extension. *Preq:* Junior standing or consent of instructor.

**AG ED 609 Agriscience Institute: Applications of Agriscience to the Secondary Curriculum 3(2,2)** Designed for pre-service and in-service agricultural educators or secondary level counselors. Surveys current developments in agriscience with an emphasis on modern practices, current job opportunities, and meeting state and national science and math education standards through agricultural instruction. Students construct lesson plans and career planning modules for high school. *Preq:* AG ED 102.

**AG ED 615 Leadership of Volunteers 3(3,0)** Provides an overview of volunteer management. The knowledge, skills, and abilities required of professional managers to involve volunteers effectively in the work of organizations are examined.

**AG ED 616 Ethics and Issues in Agriculture and the Food and Fiber System 3(3,0)** Explores ethical theories, concepts of critical thinking, and major ethical issues in American agriculture. The major social, political, economic, and ethical issues that arise in connection to the "food and fiber system" are examined and potential solutions considered.

**AG ED 623 Curriculum 2(2,0)** Curriculum goals and related planning for career, and continuing education programs.

**AG ED 625 Teaching Agricultural Mechanics 2(1,3)** Organizing course content, conducting and managing an agricultural mechanics laboratory, shop safety, microteaching demonstrations of psychomotor skills, and methods of teaching manipulative abilities.

**AG ED 628 Special Studies in Agricultural Education 1-3(1-3,0)** Students study, individually or collectively, selected topics and/or problems in agricultural education to meet the particular needs of the clientele enrolled. May be repeated for a maximum of six credits.

**AG ED 631 Methods in Environmental Education 3(3,0)** Study of various techniques appropriate for teaching environmental education. Instruction is applicable to elementary, high school, and adult-level teachers. Offered summer session only.

**AG ED 640 Program Development in Adult/Extension Education 3(3,0)** Principles, theory, and practice in planning and conducting educational programs in adult/extension settings. *Preq:* Junior standing or consent of instructor.

**AG ED (ED F, THRD) 680 Educational Applications of Microcomputers 3(2,2)** See ED F 680.

**AG ED (ED F, THRD) 682 Advanced Educational Applications of Microcomputers 3(2,2)** See ED F 682.



**AG ED 736 Internship Teaching 3(1,6)** Professional competency and program development through classroom and practical experiences in planning, conducting, and evaluating educational programs. Offered spring semester only.

**AG ED 737 Internship in Agribusiness Firms 3(1,6)** Classroom and practical experiences in selected agricultural businesses and industries. Students identify and practice entry-level competencies required in selected agribusiness and natural resource management enterprises. Offered summer session only.

**AG ED 750 Special Institute Course: Selected Topics in Agricultural Education 1-3(1-3,0)** Subject areas organized according to institute needs. Topics vary from course to course. May be repeated for a maximum of nine credits. *Preq:* Consent of instructor.

**AG ED 801 Systems for Technology Transfer 3(3,0)** Development of a philosophical foundation and utilization of cooperative learning strategies and techniques to disseminate effectively technological change for expanding clientele and diverse socioeconomic environments.

**AG ED 803 Evaluation of Instructional Programs 3(2,3)** Measurement and evaluation in general and as applied to agricultural and vocational education; selection and/or development and use of instruments for appraising educational outcomes of student achievement and total programs. Offered fall semester of odd-numbered years only. *Preq:* Consent of instructor.

**AG ED 804 Special Problems 3(2,3)** Planning, conducting, and reporting a special problem in agricultural and vocational education appropriate to students' needs.

**AG ED 805 Administration and Supervision in Agricultural Education 3(3,0)** Developing a philosophy of education including application of administrative concepts in supervising agricultural education programs. Offered spring semester of even-numbered years only. *Preq:* Experience in agricultural education.

**AG ED 810 Clinical Research in Agricultural Education 1-6(0,3-18)** Individual work on assigned research topic in agricultural education. May be repeated for a maximum of nine credits. *Preq:* AG ED (CTE, ED) 889, EX ST 801.

**AG ED 812 Development of Supervised Agricultural Experience Programs 3(3,0)** Provides secondary agriculture teachers with strategies for supervising and guiding students' supervised agricultural experiences (SAE). *Preq:* Student teaching in agricultural education.

**AG ED 815 Teaching Agricultural and Power Mechanics 3(2,3)** Methods of determining course content, organizing teaching modules in logical sequence, equipping shop, teaching agricultural and power mechanics to farm and agribusiness clientele, providing individualized instruction, and developing off-farm experience programs. Offered summer session of odd-numbered years only.

**AG ED 821 Theories and Practices of Adult Education 3(3,0)** Recent research on adult learning; a comparison of the assumptions supporting pedagogy and andragogy; teaching adults through formal classes and community organizations. Offered spring semester only. *Preq:* ED 302 or PSYCH 201 or equivalent.

**AG ED 869 Seminar 1-3(1-3,0)** Students and faculty review current topics in agricultural education.

**AG ED (CTE, ED) 889 Research in Education 3(3,0)** Problem selection; types of educational research and techniques employed; use of ERIC system and computer program packages; interpretation of research findings.

## AGRICULTURAL MECHANIZATION

**AG M 602 Drainage, Irrigation, and Waste Management 3(2,3)** Basic soil-water-plant relationships are used to determine the need for and methods of irrigation, drainage, and waste management. Topics include irrigation methods, drainage needs, drainage methods, and waste-treatment methods.

**AG M 605 Agricultural Structures and Environmental Control 3(2,3)** Technical considerations of buildings used for agriculture with emphasis on structural materials, structural adequacy, environmental control, and indoor air quality. *Preq:* AG M 221, 303, PHYS 200.

**AG M 606 Mechanical and Hydraulic Systems 3(2,3)** Study of power transmission systems for agricultural production with emphasis on mobile equipment. Characteristics, requirements, and design of both V-belt drive and roller-chain drives are presented. Emphasizes hydraulic power transmission systems, including pumps, actuators, control devices, and hydraulic circuitry. *Preq:* AG M 206, PHYS 200 or 207, or consent of instructor.

**AG M 610 Precision Agriculture Technology 3(2,3)** Principles and hands-on application of technologies supporting precision agriculture. Topics include Global Positioning System (GPS) and Geographic Information System (GIS) software, variable rate technologies, collection of spatial data, automated guidance of equipment, spatial data mapping and analysis, remote sensing, and economic considerations. *Preq:* Graduate standing.

**AG M 652 Mobile Power 3(2,3)** Study of tractors with emphasis on internal combustion engines and support systems necessary for their proper functioning; application of power, maintenance, adjustment, and general repair. *Preq:* PHYS 200, 207, or consent of instructor.

**AG M 660 Electrical Systems 3(2,3)** Students in agriculture and related curricula study electric and other utilities on the farm and in the home. Selection, installation, and maintenance of wiring systems, lighting systems, motors, controls, water systems, and waste disposal systems are emphasized. *Preq:* Junior standing.

**AG M 712 Farm Machinery Management 3(2,3)** Selection, functional analysis, and maximum utilization of existing and developing farm machinery; computer applications to programming of field operations; available capital and labor; machine size; critical field operations; growing degree days; weather; maintenance equipment, procedures, and scheduling.

**AG M 771 Selected Topics in Agricultural Mechanization 1-3(1-3,0)** Selected topics not covered in other courses. Performance is measured by oral or written reports or examinations. May be repeated for a maximum of six credits.

**AG M 781 Special Problems 1-3(1-3,0)** Independent analysis through literature review and laboratory or field research. Requires written documentation. May be repeated for a maximum of six credits.

## AGRICULTURE

**AGRIC 640 Microclimatology 3(3,0)** Study of energy balance in earth's atmosphere and soil: solar and thermal radiation, air and soil temperature, humidity, evaporation and the hydrologic cycle, wind fields. Weather variables to describe microclimates and the energy balance of plants, animals, and insects. Modification of microclimates. Rural and urban climates. *Preq:* PHYS 240 or equivalent or consent of instructor; second semester Junior standing.

## ANIMAL AND VETERINARY SCIENCES

**AVS 600 Avian Physiology 2(2,0)** Detailed study of the structure and function of organ systems of avian species with emphasis on digestion and reproduction. Students are given an opportunity to study organ system(s) of their choice using quantitative physiological techniques. Offered spring semester of even-numbered years only. *Preq:* AVS 201, 301, or consent of instructor.

**AVS 601 Beef Production 4(3,2)** Discusses breeding, feeding, reproduction, and management of beef cattle. Emphasizes production systems integrating disciplines of animal agriculture into management plans and alternatives. Practical applications of beef production and management practices are also presented. Offered fall semester only. *Preq:* AVS 202, 370.

**AVS 602 Poultry Management 4(3,2)** Emphasizes management, decision making, and application of technology to the commercial production of poultry and poultry products. Offered spring semester only.

**AVS 603 Laboratory Techniques 3(2,3)** Research and quality control techniques commonly used in dairy science and related agrisciences. Offered fall semester only. *Preq:* CH 102.

**AVS 604 Dairy Cattle Feeding and Management 4(3,2)** Fundamental principles in the care, feeding, and management of dairy cattle of all ages. Topics include general consideration in selecting a breed and the individual cow, calf raising, growth and development of dairy heifers, care and maintenance of the milking herd, and feeding for milk production. *Preq:* AVS 202, 370.



**AVS 607 Equine Theriogenology 3(2,2)** Review of reproductive anatomy and physiology in the mare and stallion; induction of estrus and ovulation; practices for optimal reproductive efficiency; semen collection, preservation, and transport; embryo transfer; regulatory aspects of reproduction by various breed registries; noninfectious and infectious diseases affecting reproduction; reproductive health management. Offered fall semester only. *Preq:* AVS 453.

**AVS 608 Pork Production 4(3,2)** Breeding, feeding, grading, marketing, and management of swine. Practical applications from all phases of the production cycle are outlined in problem form to develop the student's problem-solving ability. Offered spring semester only. *Preq:* AVS 202, 370.

**AVS 610 Domestic Animal Behavior 3(3,0)** Provides knowledge and understanding of behavior related to perception, learning, sociality, reproduction, feeding, and health for application in production, training, and design of environments for optimum health and welfare of domestic animals. *Preq:* AVS 150, 151.

**AVS 611 Animal Growth and Development 3(3,0)** Integration of the nutritional, physiological, and genetic basis for animal growth and development with application to livestock and poultry production. Includes the cellular and molecular mechanisms controlling these processes and emphasizes the genes that regulate animal products (meat, eggs, wool, and milk). *Preq:* AVS 301.

**AVS 612 Advanced Equine Management 4(3,2)** Further discussion of special considerations of the equine regarding housing, manure management, nutrition, reproduction, transportation, and behavior. Students gain insight into how horses differ from other livestock species and their unique requirements for the above systems. *Preq:* AVS 370.

**AVS (BIOSC, MICRO) 614 Basic Immunology 4(3,3)** See MICRO 614.

**AVS 615 Contemporary Issues in Animal Science 3(3,0)** Provides knowledge, understanding, and critical analytical skills on current issues in animal agriculture in diverse regional, national, and global social-cultural and political environments as they impact animals and man. *Preq:* AVS 150, 151, Junior standing in Animal and Veterinary Sciences.

**AVS 618 Muscle Biology and Lean Meats 3(2,2)** Biology of animal muscle, connective, fat, and bone tissue with laboratory emphasis on low-fat sausages and restructured, value-added meat products. *Preq:* AVS 202.

**AVS 620 Poultry Science On-line 3(3,0)** On-line course covering the physiology, nutrition, health, reproduction, genetics, breeding, housing, and management of commercial poultry species including the processing of meat and egg products.

**AVS 625 Poultry Products Grading and Technology 3(2,3)** Factors important in the quality of poultry products are considered. The effects of production, handling, packaging, and storage on consumer acceptability are discussed. Quality evaluation is considered from the standpoint of tenderness, flavor, microbiology, and USDA grades. Offered spring semester of odd-numbered years only. *Preq:* AVS 108, 202.

**AVS 630 Dairy Processing I 4(3,3)** Processing and distribution of fluid milk and other dairy products with emphasis on composition, quality control, chemical, microbiological, and public health aspects. Offered fall semester of alternate years only. *Preq:* BIOL 104, CH 102.

**AVS 631 Dairy Processing II 4(3,3)** Continuation of AVS 630, with emphasis on processing of cultured dairy products and frozen dairy products; processing procedures, quality control, ingredients, formulations; compositional and cultural characteristics of cultured and frozen dairy products are discussed. Offered spring semester of alternate years only. *Preq:* AVS 430.

**AVS 651 Poultry Nutrition 2(2,0)** Nutrient requirements of chickens, turkeys, and game birds and methods of determining these requirements. Deficiencies and excesses of vitamins and minerals and the effects of naturally occurring toxins are considered. Hand formulation and linear programming are discussed. Offered fall semester of odd-numbered years only.

**AVS 652 Poultry Nutrition Laboratory 1(0,3)** Provides training in basic laboratory skills and common laboratory methods used in poultry nutrition.

**AVS 653 Animal Reproduction 3(2,2)** Reproductive physiology and endocrinology of mammals with emphasis on farm animals and frequent reference to reproduction in laboratory animals and humans. *Preq:* AVS 150, 301.

**AVS 655 Animal Reproductive Management 1(0,3)** Physiology and endocrinology of pregnant and nonpregnant cows are discussed. Emphasis is on methods of artificial insemination, pregnancy detection, and computer record keeping for achieving a high level of reproductive efficiency in cattle. *Preq:* AVS 150, 301; AVS 453 (or concurrent enrollment).

**AVS 658 Avian Microbiology and Parasitology 3(3,0)** Agents causing poultry diseases; the diagnosis, prevention, and treatment of specific diseases; their economic and public health significance. Offered fall semester of even-numbered years only.

**AVS 661 Physiology of Lactation 2(2,0)** Anatomy and development of the mammary gland; physiological and biochemical regulation of mammary growth and milk secretion with emphasis on farm animals and reference to other mammals. Offered spring semester only. *Preq:* AVS 202, BIOCH 305.

**AVS 670 Animal Genetics 3(3,0)** Fundamental principles relating to the breeding and improvement of livestock including variation, heredity, selection, linebreeding, inbreeding, crossbreeding, and other related subjects. *Preq:* AVS 150.

**AVS (BIOSC) 680 Vertebrate Endocrinology 3(3,0)** See BIOSC 680.

**AVS 801 Selected Topics 1-3(1-3,0)** Current topics of special interest in animal, dairy, or veterinary sciences not covered in other courses. May be repeated for credit. *Preq:* Consent of coordinating instructor.

**AVS 802 Meat Technology 3(3,0)** Biochemistry, histology, and microbiology of fresh, frozen, cured, smoked, and processed meats; quality of meats and meat products; processing methods; nutritive value; research techniques. *Preq:* AVS 353.

**AVS 803 Physiology of Reproduction and Milk Secretion 3(3,0)** Advanced concepts of steroidogenesis, gametogenesis, fertilization, placentation, embryogenesis, embryonic-endometrial relationships, parturition, and lactation and the influence of hormones on these processes. Students evaluate the most recent scientific literature in these areas for information, experimental methods, and validity of authors' conclusions and select a problem, review related literature, and write a research proposal for solving the problem. *Preq:* AVS 453 and 461 or consent of instructor.

**AVS 804 Methods in Animal Breeding 3(3,0)** Gene and zygotic frequency, system of mating, heritabilities, genetic consequences of selection, and criteria for evaluating improvement in all domestic livestock. *Preq:* AVS 652.

**AVS 808 Industrial Dairy and Meat Science 3(1,6)** Managerial training for operating food plants with particular emphasis on regulations, policy, and decision making for dairy plants and meat plants. *Preq:* Consent of instructor.

**AVS 820 Animal and Veterinary Sciences Graduate Seminar 1(1,0)** Ongoing research, evaluation of research needs, research techniques, critical reviews, and discussions of published research in all areas of the animal, dairy, and veterinary sciences.

**AVS 822 Special Problems 1-3(0,3-9)** Laboratory, library, or field study of problems related to animal, dairy, and veterinary sciences emphasizing development and testing of hypotheses and reporting of results. May be repeated for a maximum of four credits. *Preq:* Consent of instructor supervising study.

**AVS 825 Immunobiology 3(3,0)** Conceptual approach to immunobiology emphasizing the molecular and cellular aspects. Classical and current literature is the major source for the discussion/lecture format. Offered spring semester only. *Preq:* Consent of instructor.

**AVS 891 Master's Thesis Research 1-12**

## ANIMAL PHYSIOLOGY

**AN PH (BIOSC) 801 Electron Microscopy of Biological Specimens 3(1,6)** Concepts and practice in preparing biological specimens for electron microscopy: fixing; embedding; thin-sectioning; staining; operating microscopes; and photographing, developing, printing, and interpreting micrographs. Students must achieve proficiency with selected specimens including writing brief research proposals, preparing specimens, studying specimens with electron microscope, and interpreting micrographs. *Preq:* Consent of instructor.

**AN PH 802 Selected Topics 1-3(1-3,0-3)** Current topics of special interest in animal physiology not covered in other courses. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.

**AN PH 806 Care and Use of Research Animals 3(1,6)** Demonstration and practice of humane use and care of animals in research; pain, analgesia, and anesthesia; regulatory aspects of the use of animals in teaching and research; surgical techniques and sample collection. Offered fall semester only. *Preq:* BIOSC 659 or consent of instructor.



**AN PH 807 Special Problems in Animal Physiology 1-3(1-3,0)** Research not related to a thesis. May include a comprehensive review of related literature.

**AN PH 812 Digestive-Metabolic, Excretory, and Respiratory Physiology 5(4,3)** Advanced concepts of mechanisms and functions of gastrointestinal tract (mastication, salivation, digestion, absorption, metabolism, excretion), kidney (anatomy, filtration, secretion, reabsorption), and respiratory systems (transport, exchange, and utilization of gases); the action of the nervous system, hormones, and pharmacologic agents on these organ systems. Offered fall semester of even-numbered years only. *Preq:* BIOSC 659 or consent of course coordinator.

**AN PH 814 Membrane, Cardiovascular, and Neuromuscular Physiology 5(4,3)** Advanced concepts in membrane physiology (permeability, action potentials, specialized functions), cardiovascular physiology (functions of the heart, blood-vascular system in maintaining acid-base balance, clotting mechanisms, homeostasis, circulation), neuromuscular physiology (anatomy and function of the nervous system, special senses, reflexes, control of muscular activity), the action of several pharmacologic agents on muscle and nerve functions. Offered spring semester of even-numbered years only. *Preq:* BIOSC 659 or consent of course coordinator.

**AN PH 851 Animal Physiology Seminar 1(1,0)** Current research and development in animal physiology through related literature and student and faculty participation. May be repeated for a maximum of two credit hours.

**AN PH 891 Master's Thesis Research 1-12**

**AN PH 991 Doctoral Dissertation Research 1-12**

## ANTHROPOLOGY

**ANTH 603 Qualitative Methods 3(3,0)** Methods and techniques of qualitative field research including participant observation, ethnographic interviewing, data analysis, and report writing. *Preq:* ANTH 201 or consent of instructor.

## ARCHITECTURE

**ARCH 603 The Modern Architecture Movement 3(3,0)** Seminar in the analysis and criticism of architectural and town building works. Course sequence includes historic and contemporary examples, literary searches, field trips, essays, and oral reports. *Preq:* Senior standing or consent of instructor.

**ARCH 604 Current Directions in Architecture 3(3,0)** Critical analysis of the development and current directions of modern movements in architecture. *Preq:* Senior standing or consent of instructor.

**ARCH 605 American Architectural Styles 1650-1950 3(3,0)** Survey of American architectural styles and the architects responsible for them, from the Colonial period to our recent past. Emphasis is on identifying architectural elements that serve as clues in determining a building's architectural style.

**ARCH 612 Architectural History Research 3(3,0)** Directed investigations related to the art and architectural history of Europe. May be repeated for a maximum of six credits. *Preq:* Junior standing or consent of instructor.

**ARCH 614 Design Seminar 3(3,0)** Exploration of topical issues in architecture, art, construction, and planning. May be repeated for a maximum of six credits. *Preq:* Junior standing or consent of instructor.

**ARCH 615 Field Sketching 3(0,6)** Study of media and techniques for expression, representation, and visual analysis through freehand perspective field drawing of the built and natural environment. *Preq:* Junior standing in School of Design and Building or consent of instructor.

**ARCH 616 Field Studies in Architecture and Related Arts 3(0,9)** Documentation and analysis of architectural structures observed during European travels in graphic and written form. May be repeated for a maximum of six credits. *Preq:* Junior standing or consent of instructor.

**ARCH 624 Product Design 3(0,9)** Furniture and product system design with emphasis on ergonomics and the relationship of form and materials. *Preq:* Senior standing and consent of instructor.

**ARCH 625 Energy in Architecture 3(3,0)** Climate design methodology and its influence on building energy patterns and architectural form. *Preq:* Senior standing and consent of instructor.

**ARCH 626 Architectural Color Graphics 3(3,0)** Architectural color graphics by computer. Theories of color classification and interaction; application of color theories to art and architecture. *Preq:* Consent of instructor.

**ARCH 627 Advanced Color Graphics 3(3,0)** Theories of color classification and interaction; three-dimensional color modeling by computer; advanced application of color theories to art and architecture. *Preq:* ARCH 426 or consent of instructor.

**ARCH 628 Computer-Aided Design 3(2,3)** Introduction to the concepts, skills, and applications of computer-aided design as they relate to the practice of architecture. *Preq:* Senior standing or consent of instructor.

**ARCH 629 Architectural Graphics 3(3,0)** Provides students with an understanding of concepts, skills, techniques, and strategies of visual presentation/graphics as they relate to the design professions—architects/landscape architects. *Preq:* Graduate standing or consent of instructor.

**ARCH 630 Theories and Philosophies of Technology and Architecture 3(3,0)** Theoretical and practical examination of technology and architecture from pre-modern and modern viewpoints to study its nonneutral role in shaping and reflecting knowledge, beliefs, and actions within a cultural context.

**ARCH 631 Virtual Reality in Architecture 3(3,0)** Introduction and exploration of the theories and concepts of virtual reality and their use in modeling three-dimensional spaces; computer modeling, lighting and texture mapping. Projects focus on the creation and presentation of a virtual environment. *Preq:* Junior standing or consent of instructor.

**ARCH 640 New York Field Study 3(3,0)** Study of architecture, art, planning, and urban design of New York. Two weeks' residence are required with scheduled field trips to relevant sites in all five boroughs, with counseling to determine research interests. Guidance is provided to resources in the city. A final report is required. Offered Maymester only.

**ARCH 685 Health Care Facilities 3(3,0)** Introduces concepts, organization, and direction of health and health-care services within the context of health-care delivery systems. Special emphasis is placed on mental and physical health-care facilities concepts. *Preq:* Consent of instructor.

**ARCH 688 Health Care Programming 3(3,0)** Seminar on recent research and innovations in health-care facilities programming and original investigation of assigned programming problems. *Preq:* Consent of instructor.

**ARCH 699 Selected Topics in Architecture 1-3(1-3,0)** Study of selected topics in architecture. May be repeated for a maximum of nine credits, but only if different topics are covered. *Preq:* Junior standing or consent of instructor.

**ARCH 801 Architecture Seminar 3(3,0)** Contemporary issues in the architectural profession.

**ARCH 802 Phenomenology of Architecture 3(3,0)** Basic principles of phenomenological methods as they apply to the theoretical understanding of modern architecture. Emphasis is on selected writings of Heidegger, Harries, and Norberg-Schulz. *Preq:* ARCH 803.

**ARCH 803 Theories of Architecture 3(3,0)** Evolution of architectural theories from Vitruvius to the present. Emphasis is on the writings of leading architects and theorists and the impact of these theories on architectural solutions.

**ARCH 804 Seminar in Modern Masters 3(3,0)** In-depth examination of one or more related groups of architects from the 20<sup>th</sup> century. Content varies from semester to semester (Kahn, Scarpa, Barrigan, Wright, Corbusier, etc.).

**ARCH 805 Architecture and the City 3(3,0)** Seminar examining contemporary theories of urban design and the design of urban buildings; real and ideal visions of cities; their representation, archaeology, and iconography (Rossi, Kries, Ungers, Venturi, Duany, etc.).

**ARCH 820 Building Design and Construction Principles 3(3,0)** Essential principles for quality design and construction. Emphasis is on design, programming, and sustainability issues for different project types. Nature and characteristics of construction materials, equipment, and systems used in modern buildings are presented as well as how they affect function and feasibility. *Preq:* Consent of instructor.

**ARCH 821 Research Methods 3(3,0)** Foundations and procedures of architectural research; alternate research methodologies and their philosophical and epistemological limits.

**ARCH 850 Architecture Studio 6(0,18)** Architectural design studies in the context of the Genoa urban setting. May be substituted for ARCH 853 or 854 and for ARCH 857 with consent of advisor.

**ARCH 853 Architecture Studio 6(0,18)** Architectural design studies with emphasis on selected problem issues.



**ARCH 854 Architecture Studio 6(0,18)** Architectural design studies involving structured and situational problems. *Preq:* ARCH 853.

**ARCH 857 Architecture Studio 6(0,18)** Architectural design studies dealing with comprehensive problem-solving situations. *Preq:* ARCH 854.

**ARCH 858 Thesis Research 3(0,9)** Architectural predesign inventory and analysis for the thesis project. *Preq:* ARCH 854.

**ARCH 859 Thesis Manuscript 1-3(0,3-9)** Architectural predesign synthesis of research for the thesis project. *Preq:* ARCH 858.

**ARCH 878 Lighting for Architecture 3(3,0)** Interrelationships among the fields that constitute lighting and impact on building form, materials and spatial use; contributions of daylight and electric light to human response and performance. *Preq:* Consent of instructor.

**ARCH 881 Delivery of Architecture 3(3,0)** Ethical, legal, and business issues in the architectural profession. *Preq:* Professional degree program status.

**ARCH 886 Health Care Components 3(3,0)** Components and service functions of physical and mental health care delivery systems and facilities.

**ARCH 890 Directed Studies 1-5(1-5,0)** Special topics in architecture undertaken on an individual basis with faculty guidance. *Preq:* Consent of advisor.

**ARCH 891 Thesis Project 3-9(0,9-27)** Complex architectural project emphasizing design exploration and independent work. To be taken Pass/Fail only. *Preq:* ARCH 857, 858.

**ARCH 892 Comprehensive Studio 6(0,18)** Architectural design studies addressing comprehensive building projects. Topics include site design, programming, building systems design, and materials selection. Final product is a complete building design with detailed drawings and models. *Preq:* ARCH 857.

## ART

**ART 605 Advanced Drawing 3(0,6)** Advanced-level studies of drawing which explore the synthesis of refined drawing skills and philosophies of art. Student's understanding of drawing as a form of art is developed through studio practice augmented by critiques, demonstrations, lectures, field trips, and independent research. *Preq:* ART 305 or consent of instructor.

**ART 607 Advanced Painting 3(0,6)** Advanced studio course in painting. Study of contemporary painters and directions is included. Students select painting media and are expected to develop a strong direction based on prior painting experience. *Preq:* ART 307 or consent of instructor.

**ART 609 Advanced Sculpture 3(0,6)** Intensive independent studio concentration to further develop personal direction and content. Emphasis is on continued investigation of sculptural context, materials and processes, and relative historical research. *Preq:* ART 309 or consent of instructor.

**ART 611 Advanced Printmaking 3(0,6)** Culmination of process, techniques, and individual development. Students are expected to have mastered process and technique for the benefit of the image produced. Creativity and self-expression are highly emphasized as students select a process for concentrated study. *Preq:* ART 311 or consent of instructor.

**ART 613 Advanced Photography 3(0,6)** Continuation of ART 313. Advanced problems in photography. *Preq:* ART 313 or consent of instructor.

**ART 617 Advanced Ceramic Arts 3(0,6)** Students are directed toward further development of ideas and skills. Glaze calculation and firing processes are incorporated to allow for a dynamic integration of form and ideas. *Preq:* ART 317 or consent of instructor.

**ART 620 Selected Topics in Art 1-3(0,6-9)** Intense course in studio art. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Senior standing or consent of instructor.

**ART 690 Directed Studies 1-5(0,2-10)** Study of areas in the visual arts not included in other courses or additional advanced work. Must be arranged with a specific instructor prior to registration. May be repeated for a maximum of 18 credits. *Preq:* Consent of instructor.

**ART 803 Fundamentals of Visual Art 3(0,6)** Intensive introduction of visual art and design fundamentals; two- and three-dimensional studio work with emphasis on time-based media and design.

**ART 805 Visual Arts Seminar on Theories and Practice I 3(3,0)** Issues related to the practice of the artist, emphasizing theories and criticism of contemporary art.

**ART 806 Visual Arts Seminar on Theories and Practice II 3(3,0)** Continuation of ART 805.

**ART 813 Photo-Based Imaging Theories and Techniques 3(0,6)** Offers in-depth examination of photographic imaging processes for artistic expression, utilizing both traditional and digital tools and concepts. *Preq:* Master of Fine Arts student or consent of instructor.

**ART 821 Visual Arts Seminar on Art and Technology 3(3,0)** Explores the relationship between art and technology in the age of electronic media. *Preq:* Consent of instructor.

**ART 840 Visual Arts Studio 3-6(0,9-18)** Studio work in visual arts with adjunct lectures and gallery tours. May be substituted for ART 800-level visual arts studio.

**ART 850 Visual Arts Studio 3(0,9)** Concentrated and advanced work in ceramics, drawing, painting, printmaking, sculpture, photography, graphic design, or multimedia. *Preq:* Consent of department chair or instructor.

**ART 851 Visual Arts Studio 3-6** Continuation of ART 850. May be repeated for maximum of six credits. *Preq:* Consent of department chair or instructor.

**ART (CP SC) 860 Studio Computer Research 3-15(0,6-30)** Application of computer technology for the production of art. Computer research facilitates the creative approach to self-expression. Internships at animation production houses may be used for credit in this course. May be repeated for a maximum of 27 credits. *Preq:* Consent of instructor.

**ART 870 Visual Arts Studio 6(0,16)** Advanced theory; directed research in art criticism; applied work in ceramic arts, drawing, painting, sculpture, photography, graphic design, or multimedia. *Preq:* Consent of department chair or instructor.

**ART 871 Visual Arts Studio 3-6(0,8-16)** Continuation of ART 870. May be repeated for maximum of six credits. *Preq:* Consent of department chair or instructor.

**ART 880 Visual Arts Studio 3-15(0,6-30)** Continuation of ART 871. May be repeated for maximum of 15 credits. *Preq:* Consent of department chair or instructor.

**ART 891 Master's Thesis Research 3-15(0,6-30)** May be repeated for maximum of 15 credits. *Preq:* Consent of department chair or instructor.

## ART AND ARCHITECTURAL HISTORY

**A A H 611 Directed Research in Art History I 3(3,0)** Comprehensive studies and research of special topics not covered in other courses. Emphasis is on field studies, research activities, and current developments in art history.

**A A H 612 Directed Research in Art History II 3(3,0)** Continuation of A A H 611.

**A A H 623 Studies in the Art and Architecture of the Renaissance I 3(3,0)** Consideration of the visual arts and architectural monuments of the Renaissance (Western Europe from the 15<sup>th</sup>–18<sup>th</sup> centuries), with a study in depth of selected examples from the period. *Preq:* A A H 204 or 206 or consent of instructor.

**A A H 624 Studies in the Art and Architecture of the Renaissance II 3(3,0)** Consideration of the visual arts and architectural monuments of the Renaissance (Western Europe from the 15<sup>th</sup>–18<sup>th</sup> centuries), with a study in depth of selected examples from the period. *Preq:* A A H 423.

**A A H 628 Nineteenth Century Visual Arts 3(3,0)** Consideration of the visual arts of the 19<sup>th</sup> century: painting, sculpture, printmaking, ceramics, and so forth, in relation to the factors that have influenced the artist and the consequence on society. *Preq:* A A H 427.

**A A H 630 Twentieth Century Art I 3(3,0)** Acquaints students with the major artists' monuments and issues of the Modern period in art. Through lecture/discussions and the reading of primary sources, course places the major modern movements in the context of the period (1860s–1945). *Preq:* Consent of instructor.

**A A H 632 Twentieth Century Art II 3(3,0)** Overview of trends in art and architecture since World War II. Specific artists, artworks, and movements are presented in a socio/historic context with specific emphasis on the transition from a late-modernist to a post-modern perspective. *Preq:* Consent of instructor.



**A A H (PHIL) 633 Issues in Contemporary Art and Philosophy 3(3,0)** See PHIL 633.

**A A H 635 Studies in Precolumbian Art and Architecture 3(3,0)** Familiarizes students with the art and architecture of the Western Hemisphere's Precolumbian culture in Mexico, Central, and South America. *Preq:* A A H 102 or 210 or consent of instructor.

**A A H 815 Art and Architectural History Seminar I 3(3,0)** Particular aspect of period of art/architectural history. *Preq:* Consent of instructor.

**A A H 816 Art and Architectural History Seminar II 3(3,0)** Continuation of A A H 815.

**A A H (COMM, ENGL) 840 Selected Topics 3(3,0)** See ENGL 840.

**A A H 864 Critical Issues in Visual Rhetoric 3(3,0)** Key visual rhetoric texts and important visual creations are studied to gain critical awareness of how visual codes operate in our interior worlds and public life. *Preq:* Consent of instructor.

## ASTRONOMY

**ASTR 802 Stellar Structure and Evolution 3(3,0)** Physical principles governing the structure, power, luminosity, and evolution of stars; equation of state, equations for pressure and thermal balance, heat transport, thermonuclear power, and numerical techniques of structure calculation. *Preq:* PHYS 455 or equivalent or consent of instructor.

**ASTR 803 Galactic Structure 3(3,0)** Kinematics, dynamics, and content of the Milky Way galaxy; galactic rotation, galactic distance scale, stellar populations, spiral structure, the galactic center, and the evolution of the Milky Way and other galaxies. *Preq:* Consent of instructor.

**ASTR 875 Selected Topics 1-3(1-3,0)** Study of one or more advanced topics in contemporary astrophysics. May be repeated for credit, but only if different topics are covered. *Preq:* Consent of instructor.

## ATHLETIC LEADERSHIP

**A L 653 Athletic Injuries: Prevention, Assessment and Rehabilitation 3(3,0)** Gives students an understanding of prevention, treatment, and rehabilitation procedures of injured athletes. *Preq:* A L 349.

## BIOCHEMISTRY

**BIOCH 606 Physiological Chemistry 3(3,0)** Chemical basis of the mammalian physiological processes of muscle contraction, nerve function, respiration, kidney function, and blood homeostasis is studied. Composition of specialized tissue such as muscle, nerve, blood, and bone; regulation of water, electrolytes, and acid-base balance are discussed. *Preq:* BIOCH 305 or Organic Chemistry.

**BIOCH 623 Principles of Biochemistry 3(3,0)** Study of the chemistry of amino acids, monosaccharides, fatty acids, purines, pyrimidines, and associated compounds leads to an understanding of their properties and the relationship between structure and function that makes them important in biological processes. The use of modern techniques is stressed. *Preq:* CH 224 or equivalent.

**BIOCH 631 Physical Approach to Biochemistry 3(3,0)** Study of chemical and physical properties of amino acids, lipids, nucleic acids, sugars, and their biopolymers. Physical and mathematical analyses are correlated with biological structure and function. *Preq:* BIOCH 301 with a C or better or consent of instructor. *Coreq:* Physical Chemistry.

**BIOCH 632 Biochemistry of Metabolism 3(3,0)** Study of central pathways of carbohydrate, lipid, and nucleotide metabolism. Bioenergetics, limiting reactions, and the regulation and integration of the metabolic pathways are emphasized. *Preq:* BIOCH 423 or 431 or consent of instructor.

**BIOCH 633 General Biochemistry Laboratory I 2(0,4)** Experiments selected to illustrate current methods used in biochemical research. *Coreq:* BIOCH 423 or 431.

**BIOCH 634 General Biochemistry Laboratory II 2(0,4)** Continuation of BIOCH 433. *Preq:* Concurrent enrollment in BIOCH 432.

**BIOCH 636 Nucleic Acid and Protein Biosynthesis 3(3,0)** Examines how nucleic acids and proteins are synthesized in prokaryotic and eukaryotic cells. Designed for students interested in biochemistry, cell biology, molecular biology, and cell physiology. *Preq:* BIOCH 423, 431 or 432 or consent of instructor.

**BIOCH 643 Biochemical Basis of Disease 3(3,0)** Topics in heritable human metabolic disorders including clinical features and newborn screening, genetic testing, the biochemical basis, and treatment. *Preq:* BIOCH 301, GEN 302, or consent of instructor.

**BIOCH (GEN) 805 Issues in Research 2(2,0)** Scientific writing, oral presentations, and critical evaluation of them; legal and ethical issues associated with modern biochemical research. Science job hunting, time management, and creativity for professional scientists are treated. *Preq:* Graduate enrollment in Biochemistry and Molecular Biology or consent of instructor.

**BIOCH (GEN) 810 Methods in Molecular Biology 5(3,6)** Study of prokaryotic and eukaryotic gene structure, regulation of transcription initiation, regulation of protein synthesis, and analysis of protein function. Laboratory provides intensive hands-on experience using techniques that allow dissection of these processes. *Preq:* Enrollment in Genetics or in Biochemistry and Molecular Biology or consent of instructor.

**BIOCH 814 Advanced Biochemistry 3(3,0)** Contemporary topics of functional and cellular aspects in biochemistry with particular focus on new observations, emerging ideas, and important techniques. *Preq:* Two-semester sequence in biochemistry or consent of instructor.

**BIOCH 815 Lipids and Biomembranes 3(3,0)** Isolation, chemical and physical properties, and metabolism of lipids; purification, structure, function, and biosynthesis of biomembranes. *Preq:* BIOCH 632 or consent of instructor.

**BIOCH 816 Signal Transduction 3(3,0)** Characteristics and components of signal transduction processes in model species of plants, animals, and microbes. *Preq:* BIOCH (GEN) 810 and GEN (BIOCH) 820, or consent of instructor.

**BIOCH 818 Cellular Metabolism 3(3,0)** Evolution, regulation, characterization, and manipulation of metabolic pathways. *Preq:* BIOCH 814 and GEN (BIOCH) 820, or consent of instructor.

**BIOCH (GEN) 820 Genomics and Proteomics 5(5,0)** See GEN 820.

**BIOCH 821 Proteins 3(3,0)** Isolation, composition, structure, and properties of proteins; methods of isolation, analysis, and characterization; properties of "unusual" protein systems. *Preq:* BIOCH 623 or 631 or consent of instructor.

**BIOCH 822 Enzymes 3(3,0)** Kinetics, mechanisms of action, inhibitions, and general properties of enzymes. *Preq:* BIOCH 623 or 631.

**BIOCH (GEN) 825 Seminar I 1(1,0)** See GEN 825.

**BIOCH 828 Supramolecular Structure 3(3,0)** Cellular structures like viruses, ribosomes, and various membrane systems, including rafts and some organelles, are described using modern methods of structural characterization. The methods and the theory of the methods are discussed along with the structures and their functions. *Preq:* BIOCH 814 or consent of the instructor.

**BIOCH 831 Physical Biochemistry 3(3,0)** Description and theory of physical methods and instrumentation used in analysis of biological macromolecules. *Preq:* BIOCH 623 or 631, one semester of physical chemistry, or consent of instructor.

**BIOCH 832 Structure and Function of Nucleic Acids 3(3,0)** Physical, chemical, and biochemical properties of nucleotides, oligonucleotides, RNA, and DNA; antisense oligonucleotides and aptmers; unusual structures of RNA and DNA; nucleic acids-protein interactions; nucleic acids-metal interactions; small RNAs and RNA interference; catalytic nucleic acids; nucleic acids repair. *Preq:* BIOCH 814 or GEN 814 or consent of instructor.

**BIOCH 841 Biochemical Genetics 3(3,0)** Regulation of replication and transcription. Students present papers from recent literature and write a research proposal. *Preq:* One year of biochemistry or consent of instructor.

**BIOCH (GEN) 851 Seminar II 1(1,0)** Current topics in biochemistry.

**BIOCH 890 Special Topics in Biochemistry 1-6(1-6,0)** Group discussions of recent developments in biochemical research. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* BIOCH 814 or consent of instructor.

**BIOCH 891 Master's Thesis Research 1-12**

**BIOCH 991 Doctoral Dissertation Research 1-12**

## BIOENGINEERING

**BIO E (C M E) 680 Research Principles and Concepts 1(1,0)** Introduces seniors and graduate students to principles and practices of scientific research. Topics include developing scientific concepts, developing projects, pursuing research, collaborating in multidisciplinary teams, patenting and publishing technical and scientific information, and reviewing professional and ethical standards of performance. To be taken Pass/Fail only.



**BIO E 800 Seminar in Bioengineering Research 1(2,0)** Original research in bioengineering; weekly one-hour seminar associated with weekly recitation covering seminar preparation, presentation, professional writing, bioengineering ethics, and related topics. To be taken Pass/Fail only.

**BIO E 801 Biomaterials 3(3,0)** Structure and properties of the main classes of materials used in artificial organs and surgical implants; metals, ceramics, polymers, composites, and materials of biological origin; mechanical properties, corrosion, and design. *Preq:* Consent of instructor.

**BIO E 802 Compatibility of Biomaterials 3(1,6)** Determining compatibility of biomaterials with the physiological environment; optical microscopy, microradiography, and ultraviolet fluorescence; normal histology of tissues, basic pathological reactions, and tissue reactions to materials.

**BIO E 803 Polymeric Biomaterials 3(3,0)** Interplay of physicochemical properties of polymeric materials and the design of biomedical devices and their in vitro and in vivo performance; critical manufacturing aspects of selected augmentation and prosthetic devices for soft and hard tissues; analysis of case studies and reports on recent research findings. *Preq:* Consent of instructor.

**BIO E 804 Metallic and Ceramic Implant Materials 3(3,0)** Interaction between implant material and host tissue, selection of materials for different applications, influences of material and host tissue performance on implant design and on in vitro testing of implant materials and devices. *Preq:* BIO E 801 and consent of instructor.

**BIO E 807 Nanotechnology and Biomaterials 3(3,0)** Emerging field of nanotechnology and its relation to solving bioengineering and health-related problems is treated. The promise of nanotechnology in the creation and utilization of materials and devices at the level of atoms and molecules. New scientific approaches, research tools, clinical tools, and devices are presented.

**BIO E 812 Orthopedic Engineering and Pathology 3(3,0)** Interdisciplinary study of orthopedic cases (bone growth, bone remodeling, osteoarthritis, implant fixation, and joint replacements); biomechanical, biomaterials, and clinical diagnosis of failed implants (total joints, fracture fixation, and spinal instrumentation); basic concepts of orthopedic pathology for engineers. *Preq:* BIO E 801, 802, 820, and 882, or consent of instructor.

**BIO E 820 Structural Biomechanics 3(3,0)** Mechanical functions of the human body treated as an engineering structure and the devices used to assist and supplement these functions; movement of the musculoskeletal system; locomotion; gait; prehension; lifting; function of artificial limbs; orthopedic prostheses and braces; effect of vibration and impact on the body; mathematical and other models of the body. *Preq:* Consent of instructor.

**BIO E 823 Vascular Engineering and Pathology 2(2,0)** Medical and bioengineering aspects of artificial vascular and cardiovascular devices; physiology and pathological aspects of patients with need for such devices; diagnostic techniques and surgical management of diseases and pathology; design aspects of current devices and selection; state-of-the-art in experiments and human clinical trials. *Preq:* BIO E 801, 802, and 846, or consent of instructor.

**BIO E 846 Biomedical Basis for Engineered Replacement 3(3,0)** Form and function of human organs, major systems, and examples of engineering repair and replacement methods are presented in light of pathological or traumatic organ malfunction. Core course for all Bioengineering graduate students, taken preferably during their first fall semester.

**BIO E 847 Transport Processes in Bioengineering 4(4,0)** Cardiovascular systems and regulation; physiology of blood, heart, and organ blood flow; properties of blood as a fluid; fluid flow equations; turbulence; pulse propagation; respiration and control of breathing; gas exchange; heart-lung bypass devices; renal function and control; artificial kidney devices; heat flow and temperature regulation. *Preq:* BIOSC 459.

**BIO E 848 Cellular Interactions with Biomaterials 4(2,2)** Cell biological concepts and issues relevant to cell-biomaterial interactions; methods for studying cell structure and function including basic cell culture techniques and in vitro biocompatibility analyses; biomaterial physicochemical properties which influence cellular interactions; interactions between implant materials and host tissues at the cellular and molecular level; overview of tissue engineering.

**BIO E 849 Tissue Engineering 3(3,0)** Principles and practices of bioartificial organ and tissue development; cellular/material interaction and translation of information from two-dimensional surfaces to three-dimensional scaffolds; selection and processing of biomaterials to form tissue scaffolds; analysis of tissue engineered devices, standards, and regulation. *Preq:* BIO E 801, 846.

**BIO E 850 Selected Topics in Biomedical Engineering 1-4(0-4,12-0)** Advanced topics in bioengineering intended to develop in-depth areas of particular student interest. Credit may be earned for more than one semester. *Preq:* Consent of instructor.

**BIO E 870 Bioinstrumentation 3(2,2)** Concepts and techniques of instrumentation in bioengineering emphasizing effects of instrumentation on the biological system under investigation; transducers and couplers; data conversion; conditioning and transmission; experimental problems in acute and chronic procedures with static and dynamic subjects.

**BIO E 882 Biomaterials Implantology 4(2,6)** All phases of experimental surgery including selection of animal models, preparation of animals for surgery, general and special surgical techniques, and basic and applied instrumentation. *Preq:* BIOSC 459 or equivalent.

**BIO E 890 Internship 1-5** Observation and assignment in a medical college, dental college, hospital, veterinary clinic, dental clinic, health service, or industrial department. *Preq:* Consent of department chair.

**BIO E 891 Master's Thesis Research 1-12**

**BIO E 892 Nonthesis Independent Study in Bioengineering 1-6** Independent study in bioengineering for work necessary to complete requirements for the Master of Science degree in Bioengineering, nonthesis option. May be repeated for additional credit. To be taken Pass/Fail only.

**BIO E 991 Doctoral Dissertation Research 1-12**

## BIOLOGICAL SCIENCES

**BIOSC (ENT) 600 Insect Morphology 4(3,3)** See ENT 600.

**BIOSC 601 Plant Physiology 3(3,0)** Relations and processes that pertain to maintenance, growth, and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products, and liberation of energy. *Preq:* BIOL 104 or 111 or BIOSC 205 and CH 102. *Coreq:* BIOSC 602.

**BIOSC 602 Plant Physiology Laboratory 1(0,3)** Laboratory exercises and experiments designed to indicate the relations and processes that pertain to maintenance, growth, and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products and liberation of energy. *Coreq:* BIOSC 601.

**BIOSC 603 Protozoology 3(3,0)** Survey of the protozoa with emphasis on organization and function. Representative types of both free-living and parasitic forms are examined for each major taxon. *Preq:* BIOL 104 or 111.

**BIOSC 604 Protozoology Laboratory 2(1,2)** Laboratory exercises reinforce the material presented in BIOSC 403/603 and introduce techniques used in collection, preservation, and examination of protozoans. *Coreq:* BIOSC 603.

**BIOSC (GEN) 605 Molecular Genetics of Eukaryotes 3(3,0)** See GEN 605.

**BIOSC 606 Introductory Plant Taxonomy 3(3,0)** Introduction to the basic principles and concepts of plant systematics with emphasis on the plants of South Carolina. *Preq:* BIOL 104 or 111 or BIOSC 205. *Coreq:* BIOSC 607.

**BIOSC 607 Plant Taxonomy Laboratory 1(0,3)** Introduction to the basic techniques of plant taxonomy with laboratory and field emphasis on the flora of South Carolina. *Coreq:* BIOSC 606.

**BIOSC 608 Comparative Vertebrate Morphology 3(3,0)** Phylogeny and diversity of vertebrates and study of their comparative morphology, leading to an understanding of the relationships and functioning of living organisms. *Preq:* BIOL 104 or 111. *Coreq:* BIOSC 609.

**BIOSC 609 Comparative Vertebrate Morphology Laboratory 2(0,5)** Comparative anatomy of representative vertebrates; methods used in preparing specimens for study and display. *Coreq:* BIOSC 608.

**BIOSC 610 Limnology 3(3,0)** Detailed introduction to the physical, chemical, and biological interrelationships that characterize inland water environments. A fundamental approach to the interactions of components of the environment is developed at a theoretical level. *Preq:* Junior standing in a life science or consent of instructor.

**BIOSC 611 Limnological Analyses 2(1,2)** Examines a broad range of topics covered with both standing and running fresh waters. About one-third of the laboratory exercises address the major physical components of lakes and streams. The remainder provides rationale and methods for quantitative analyses of biota, as well as some integrated analyses of whole ecosystems. *Preq* or *Coreq:* BIOSC 610 or 643.

**BIOSC (E N R) 613 Restoration Ecology 3(3,0)** See E N R 613.



**BIOSC (AVS, MICRO) 614 Basic Immunology 4(3,3)** See MICRO 614.

**BIOSC (ENT) 615 Insect Taxonomy 3(1,6)** See ENT 615.

**BIOSC (GEN) 616 Recombinant DNA 3(3,0)** See GEN 616.

**BIOSC 617 Marine Biology 3(3,0)** Survey of the organisms that live in the sea and their adaptations to the marine environment. Characteristics of marine habitats, organisms, and the ecosystems are emphasized. *Preq:* BIOL 104, 111, or consent of instructor.

**BIOSC (GEN, MICRO) 618 Biotechnology I: Nucleic Acids Techniques 4(2,4)** See GEN 618.

**BIOSC 620 Neurobiology 3(3,0)** Broad background in neurobiology. Topics include neuroanatomical structure-function; conduction in the neuron; neurite growth and development; neuromuscular junction; chemistry, physiology, and pharmacology of specific neurotransmitters and receptors; visual process; axoplasmic transport; hypothalamic-pituitary regulation; theories of behavior; theories of learning and memory. *Preq:* BIOCH 301 or 305 or consent of instructor.

**BIOSC 625 Introductory Mycology 3(3,0)** Introduction to the biology of all the groups of fungi and some related organisms, with considerations of the taxonomy, morphology, development, physiology, and ecology of representative forms. *Preq:* BIOL 104 or 111 or BIOSC 205.

**BIOSC 626 Mycology Practicum 2(1,2)** Application of the principles of mycological techniques, including isolation, culture, identification, and microscopic study of fungi. Examples from all major groups of fungi are included. *Preq or Coreq:* BIOSC 625.

**BIOSC (ENT, ENTOX) 630 Toxicology 3(3,0)** See ENTOX 630.

**BIOSC 632 Animal Histology 3(3,0)** Structural and functional study of the basic tissues of animals and tissue makeup of organs. Emphasis is on light microscopy level with selected tissue studied at the electron microscope level. *Preq:* BIOSC 303 or consent of instructor. *Coreq:* BIOSC 633.

**BIOSC 633 Animal Histology Laboratory 2(1,2)** Microscopic examination of basic animal tissue types and the tissue makeup of organs which comprise systems. *Coreq:* BIOSC 632.

**BIOSC (ENT) 636 Insect Behavior 3(2,3)** See ENT 636.

**BIOSC 640 Developmental Animal Biology 3(3,0)** Events and mechanisms responsible for the development of multicellular animals. Gametogenesis, fertilization, embryonic development, cellular differentiation, morphogenesis, larval forms and metamorphosis, asexual reproduction, regeneration, malignancy, and aging are analyzed in terms of fundamental concepts and control processes. *Preq:* BIOCH 301 or 305 or consent of instructor. *Coreq:* BIOSC 650.

**BIOSC 641 Ecology 3(3,0)** Study of basic ecological principles underlying the relationships between organisms and their biotic and abiotic environments. Includes physiological, population, and community ecology, with applications of each to human ecological concerns. *Preq:* BIOL 104, 111, BIOSC 205, or consent of instructor.

**BIOSC 642 Biogeography 3(3,0)** Study of patterns of distribution of plants and animals in space and time. *Preq:* BIOSC 302 or 303 and 304 or 305 or consent of instructor.

**BIOSC 643 Aquatic Ecology 3(3,0)** Study of basic ecological principles and concepts as they apply to aquatic environments: rivers and streams, lakes and ponds, reservoirs, swamps, marshes, estuaries, and marine systems. *Preq:* Junior standing in a life science or consent of instructor.

**BIOSC 645 Ecology Laboratory 2(1,2)** Modern and classical approaches to the study of ecological problems discussed in BIOSC 441. Students are introduced to field, laboratory, and computer-based analyses of plant and animal populations and communities. *Preq or Coreq:* BIOSC 641.

**BIOSC 646 Plant Ecology 3(3,0)** Ecology of plants in relation to their biotic and abiotic environments. Individual organisms, populations, and communities are considered with an emphasis on seed plants in terrestrial environments. *Preq:* BIOL 104, 111, or BIOSC 205, or consent of instructor.

**BIOSC 647 Plant Ecology Laboratory 2(1,2)** Experimental and observational approach to addressing principles discussed in BIOSC 646. Students are introduced to field and laboratory methods involving individual organisms, populations, and communities. *Preq or Coreq:* BIOSC 646 or consent of instructor.

**BIOSC 650 Developmental Biology Laboratory 2(1,2)** Examines a broad range of topics concerned with the development of multicellular animals such as gametogenesis, fertilization, embryonic development, cell differentiation, morphogenesis, larval metamorphosis, and regeneration. Laboratory exercises provide the rationale and methods for the descriptive and experimental analysis of development in representative invertebrates and vertebrates. *Preq or Coreq:* BIOSC 640 or equivalent.

**BIOSC 652 Plant Anatomy and Morphology 3(3,0)** Study of the anatomy, reproduction, and phylogenetic relationships of vascular plants. *Preq:* BIOL 104, 111, BIOSC 205, or consent of instructor.

**BIOSC 653 Plant Anatomy and Morphology Laboratory 2(1,2)** Laboratory focusing on the anatomy, reproduction and phylogenetic relationships of vascular plants. *Coreq:* BIOSC 652.

**BIOSC 654 Plant Virology 4(3,3)** Study of plant viruses: their morphology, biochemistry, purification, and transmission; symptoms resulting from virus infection; virus vector relationships. Serological and nucleic acid hybridization procedures. Diagnosis of viral diseases and the identification of causal agents. Replication of plant viruses, the interaction between viral host and plant genome. Control of plant viral diseases. *Preq:* BIOCH 301, MICRO 305, or consent of instructor.

**BIOSC (ENT) 655 Medical and Veterinary Entomology 3(2,3)** See ENT 655.

**BIOSC 656 Medical and Veterinary Parasitology 3(3,0)** Introduction to parasitism in the animal kingdom; emphasizes basic and applied principles related to economically and medically important diseases. Classical and experimental approaches to the study of parasitism are examined in reference to protozoa, helminths, and arthropods. *Preq:* BIOL 104 or 111. *Coreq:* BIOSC 657.

**BIOSC 657 Medical and Veterinary Parasitology Laboratory 2(1,2)** Laboratory to reinforce material presented in BIOSC 656. Introduces students to both live and preserved human/animal parasites. Also introduces techniques used in collection, preservation, and examination of animal parasites. *Coreq:* BIOSC 656.

**BIOSC 658 Cell Physiology 3(3,0)** Study of the chemical and physical principles of cell function emphasizing bioenergetics and membrane phenomena. *Preq:* BIOCH 301 or 305 or consent of instructor.

**BIOSC 659 Systems Physiology 3(3,0)** Physiological systems of vertebrates and their homeostatic controls. Function of the major physiological systems is described in terms of anatomical structure and chemical and physical principles. *Preq:* One year each of biology, chemistry, and physics or consent of instructor.

**BIOSC 660 Systems Physiology Laboratory 2(1,2)** Modern and classical experimental methods are used to demonstrate fundamental physiological principles discussed in BIOSC 659. Students are introduced to computer-aided data acquisition and computer simulations of physiological function. *Preq or Coreq:* BIOSC 659.

**BIOSC 661 Cell Biology 3(3,0)** In-depth analysis of how and where intracellular and extracellular molecules control general and specific cellular functions such as gene expression, secretion, motility, signaling, cell-cycle control and differentiation. Taught and graded at a level where students are expected to infer from and integrate cellular events. *Preq:* BIOCH 301 or consent of instructor.

**BIOSC 662 Cell Biology Laboratory 2(1,2)** Accompanies BIOSC 661; focuses on molecular and microscopic analysis of eukaryotic cells. *Coreq:* BIOSC 661.

**BIOSC 664 Mammalogy 3(2,3)** Origin, evolution, distribution, structure, and function of mammals with laboratory emphasis on the mammals of South Carolina. Field collection required. *Preq:* BIOSC 303 or consent of instructor.

**BIOSC (GEN, HORT) 665 Plant Molecular Biology 3(3,0)** See HORT 665.

**BIOSC 668 Herpetology 3(2,3)** Systematics, life history, distribution, ecology, and current literature of amphibians and reptiles. Laboratory study of morphology and identification of world families and U.S. genera, as well as all southeastern species. Field trips are required. *Preq:* BIOSC 303 or consent of instructor.

**BIOSC (ENT, WFB) 669 Aquatic Insects 3(1,6)** See ENT 669.

**BIOSC 670 Animal Behavior 3(3,0)** Historical and modern developments in animal behavior emphasizing the evolutionary and ecological determinants of behavior. A synthesis of ethology and comparative psychology. *Preq:* BIOSC 302 or 303 or consent of instructor.

**BIOSC 671 Animal Behavior Laboratory 1(0,3)** Laboratory exercises that explore the behavior of animals. Emphasis is on behavioral observation and analysis and presentation of findings in a report format. *Preq or Coreq:* BIOSC 670 or consent of instructor.



**BIOSC 672 Ornithology 4(3,3)** Biology of birds: their origin and diversification, adaptations, phylogeny, classification, structure and function, behavior, ecology, and biogeography. Field identification is emphasized, and field trips are required. *Preq:* BIOSC 303 or consent of instructor.

**BIOSC 675 Comparative Physiology 3(3,0)** Physiological systems of invertebrates and vertebrates with emphasis on environmental adaptation. Physiological principles as they relate to metabolism, thermoregulation, osmoregulation, respiration, and neural and integrative physiology. *Preq:* One year each of biology, chemistry, and physics or consent of instructor.

**BIOSC 676 Comparative Physiology Laboratory 2(1,2)** Modern classical experimental methods demonstrate fundamental physiological principles discussed in BIOSC 475. Students are introduced to computer-aided data acquisition and manipulation as well as computer simulations of physiological function. *Preq or Coreq:* BIOSC 675.

**BIOSC 677 Ichthyology 3(2,3)** Systematics, life history, distribution, ecology, and current literature of fish. Laboratory study of morphology and identification of U.S. genera and all Southeastern species. Field trips are required. *Preq:* BIOSC 303 or consent of instructor.

**BIOSC (AVS) 680 Vertebrate Endocrinology 3(3,0)** Introduction to the basic principles of neuroendocrine integration and homeostatic maintenance in vertebrates. Comparative morphology and physiology of various endocrine tissues and hormone chemistry and modes of action are considered. *Preq:* BIOSC 303, organic chemistry or consent of instructor.

**BIOSC 730 SC Life: Topics for Teachers 3(2,2)** Topics relating to the SC Life curriculum. Lectures, laboratories, and extensive field studies focus on the natural history and biodiversity of South Carolina. Restricted to elementary and secondary school teachers. May be repeated for credit, but only if different topics are covered. *Preq:* Consent of instructor.

**BIOSC (AN PH) 801 Electron Microscopy of Biological Specimens 3(1,6)** See AN PH 801.

**BIOSC (ENTOX) 811 Immunotoxicology 3(3,0)** See ENTOX 811.

**BIOSC 812 Seminar 1(1,0)** Review and presentation of current literature in biological sciences. May be repeated for a maximum of four credits. To be taken Pass/Fail only. *Preq:* Consent of instructor.

**BIOSC 871 Selected Topics 1-4(1-4,0)** Cellular and developmental biology, ecology, behavior, evolutionary biology, molecular biology, physiology, systematics, and other topics of interest to graduate students in the biological sciences. May be repeated for credit, but only if different topics are covered. *Preq:* Consent of instructor.

**BIOSC 872 Selected Topics Laboratory 1-4(0,2-8)** Specialized laboratory experiences in cellular and developmental biology, ecology, behavior, evolutionary biology, molecular biology, physiology, systematics, and other topics of interest to graduate students in the biological sciences. May be repeated for credit, but only if different topics are covered. *Preq:* Consent of instructor.

## BIOLOGY

**BIOL 710 Selected Topics for Teachers 1-6(0-6,0-18)** One or more topics organized according to institute needs. Lecture and laboratory emphasize the incorporation of new or updated subject matter into classroom instruction. Restricted to elementary and secondary school teachers. May be repeated for credit, but only if different topics are covered.

## BIOSYSTEMS ENGINEERING

**B E (CSENV) 608 Land Treatment of Wastewater and Sludges 3(3,0)** See CSENV 608.

**B E 612 Heat and Mass Transport in Biosystems Engineering 3(3,0)** Fundamentals of heat and mass transport used in engineering design and analysis of biological systems; principles of steady state and transient energy and mass balances including chemical and biological generation terms. *Preq:* B E 312, MTHSC 208. *Coreq:* M E 310.

**B E 614 Biosystems Engineering Unit Operation 3(2,3)** Applies the basic principles of statics, dynamics, and thermodynamics to design of mechanical and electrical systems supporting biological operations and processes. *Preq:* B E 314, M E 310.

**B E 615 Instrumentation and Control for Biosystems Engineers 4(3,3)** Overview of modern instrumentation techniques and digital electronic components and subsystems to integrate them into digital data acquisition and control systems for biosystems. Laboratory use of equipment is emphasized. Topics include characteristics of instruments, signal conditioning, transducer theory and applications, programmable logic controllers, and digital data acquisition and control. *Preq:* E C E 307.

**B E 622 Hydrologic Modeling of Small Watersheds 3(3,0)** Design of structures and development of best management practices for runoff, flood, and sediment control from rural and urban areas, including natural and disturbed watersheds. Topics include modeling of prismatic and non-prismatic channels, culverts, and detention/retention ponds. *Preq:* B E 322 or consent of instructor.

**B E (CH E) 628 Biochemical Engineering 3(3,0)** Use of microorganisms and enzymes for the production of chemical feedstocks, single-cell protein, antibiotics, and other fermentation products. Topics include kinetics and energetics of microbial metabolism, design and analysis of reactors for microbial growth and enzyme-catalyzed reactions, and considerations of scale-up, mass transfer, and sterilization during reactor design. *Preq:* B E 312, BIOCH 301, MICRO 305 (for Biosystems Engineering majors); *Coreq:* CH E 312, 450 (for Chemical Engineering majors).

**B E 631 Structural Design for Biosystems 2(2,0)** Analysis and design of structures and statically determinant components with emphasis on wood. *Preq:* C E 206 or M E 302.

**B E 635 Applications in Biotechnology Engineering 3(2,3)** Bioengineering principles applied to the expanding fields of agricultural biotechnology, ecotechnology, and biomedical technology. Special applications include waste treatment and ecological engineering, bioreactor propagation of plant and animal cells and tissues, applied genomics and synthetic seed production, biosensors and biomonitoring, biological implants and materials biocompatibility. *Preq:* B E (CH E) 428.

**B E 638 Bioprocess Engineering Design 3(2,2)** Design and analysis of systems for processing biological materials. Topics include biotechnology, thermodynamics, transport processes, and biological properties related to bioprocess design and computational simulation. Unit operations include basic bioreactor operation, bioseparations, and preservation techniques. *Preq:* B E 428.

**B E 642 Properties and Processing of Biological Products 2(1,3)** Study of engineering properties of biological materials and their uniqueness as design restraints on systems for handling, processing, and preserving biological products. *Preq:* B E 333, C E 341, M E 302, 310.

**B E (EE&S, FOR) 651 Newman Seminar and Lecture Series in Natural Resources Engineering 1(0,2)** Topics dealing with development and protection of land, air, water, and related resources are covered by seminar with instructor and invited lecturers. Current environmental and/or resource conservation issues are addressed. *Preq:* Senior standing, consent of instructor.

**B E 664 Non-Point Source Management in Engineered Ecosystems 3(2,3)** Fundamentals of non-point source pollution including quantification of environmental impact and ecosystem management related to contaminants and nutrients and to planning and design of ecological systems. *Preq:* MICRO 305, senior standing in engineering, or consent of instructor.

**B E (EE&S, I E) 684 Municipal Solid Waste Management 3(3,0)** See EE&S 684.

**B E 781 Special Problems 1-3(1-3,0)** Students select subjects and conduct library, laboratory, and/or field research. A technical report documenting study is required. May be repeated for maximum of six credits. *Preq:* Master of Engineering degree candidate.

**B E 838 Advanced Bioprocess Engineering 3(3,0)** Advanced bioprocessing techniques with emphasis on processing and modeling aspects of eukaryotic systems and associated bioproducts. Modules include thermal processing, supercritical fluid extraction, and advanced biological thermodynamics, chromatography, and spectroscopy. *Preq:* B E 438 or consent of instructor.

**B E 865 Heat and Moisture Transfer in Biological Materials 3(3,0)** Heat and moisture diffusion in biological materials; criteria for selecting proper operational mathematics to solve certain boundary value problems; integral transforms of Laplace, Fourier, and Hankel applied to various geometric configurations; influence of respiration heat and transpiration moisture production. *Preq:* MTHSC 434 or 453 or consent of instructor.



**B E 871 Selected Topics in Agricultural Engineering 1-3(1-3,0)** Supervised, in-depth study of an area not covered in other courses. Performance is measured by oral and written reports and/or by examination. May be repeated for a maximum of six credits.

**B E 882 Systems Engineering 3(3,0)** Systems analysis methods applied to engineering of biological and agricultural operations; development of equations of motion, system analogs, and computer models and simulations; linear control analysis and stability. *Preq:* Consent of instructor.

**B E 891 Master's Thesis Research 1-12**

**B E 901 Special Problems in Agricultural Engineering 3(3,0)** Library and/or laboratory research on one of the following subjects, depending on student's field of study or interests: power and machinery, soil and water resources, farm structures, electric power and processing, food engineering, forest engineering or waste management. A technical report is required.

**B E 991 Doctoral Dissertation Research 1-12**

## BOTANY

**BOT 821 Inorganic Plant Metabolism 3(3,0)** Plant, soil, water, and nutrient relations; permeability; uptake and translocation; transpiration; mineral nutrition. Offered fall semester of odd-numbered years only. *Preq:* BIOSC 601 and 602 or consent of instructor.

**BOT 822 Organic Plant Metabolism 3(3,0)** Respiration and photosynthesis; synthesis, translocation, storage, transformation, and degradation of organic materials, fats, carbohydrates, proteins, pigments, and nucleic acids. Offered spring semester of even-numbered years only. *Preq:* BIOSC 601 and 602 and BIOCH 623 or consent of instructor.

**BOT 823 Plant Growth and Development 3(3,0)** Vegetative and reproductive growth and development from seed to maturity, flowering, fruiting and senescence; natural and synthetic growth regulators; morphogenesis. Offered fall semester of even-numbered years only. *Preq:* BIOSC 601, 602, and organic chemistry; or consent of instructor.

**BOT 824 Mode of Action of Growth Substances 4(3,3)** Physiology and biochemistry of both natural and synthetic growth regulators, hormones, growth retardants, herbicides, and other inhibitors; methodology and mechanism of action. Offered spring semester of odd-numbered years only. *Preq:* BIOSC 601 and 602 and general biochemistry or BOT 822 or consent of instructor.

**BOT 831 Advanced Plant Taxonomy 4(3,3)** Principles of plant classification; relationships and characteristics of major groups of vascular plants. Students collect and identify spring flora of area. Offered spring semester of odd-numbered years only. *Preq:* BIOSC 606 or consent of instructor.

**BOT 850 Plant Tissue and Cell Culture 3(2,3)** Methods and principles of plant tissue and cell culture: cloning, embryogenesis, protoplast fusion, plant regeneration, potential of plant genetic engineering. Offered fall semester of odd-numbered years only. *Preq:* Introductory plant physiology or consent of instructor.

**BOT (HORT) 851 Plant Anatomy 3(2,3)** Origin, development, and comparative structures of tissues, systems, and organs of higher plants. Offered spring semester of odd-numbered years only. *Preq:* BIOSC 652 or consent of instructor.

**BOT (HORT) 861 Plant Cell Biology 3(3,0)** Structure, development, and activities of plant cells; ultrastructural organization uniquely associated with dynamics of cellular growth and development in plants. Offered fall semester of odd-numbered years only. *Preq:* BIOSC 601 and 602 or consent of instructor.

**BOT (HORT) 921 Plant Physiology Colloquium 1(1,0)** Topics from current plant physiology literature provide a forum for criticizing research, conceiving new research ideas, developing research outlines and proposals, and integrating knowledge from various subdisciplines of plant physiology. May be repeated for credit. *Preq:* BIOSC 401/601 and 402/602 or consent of instructor.

## BUSINESS ADMINISTRATION

**M B A 802 Managerial Economics 3(3,0)** Functioning of the market economy with emphasis on the role of prices in determining the allocation of resources; the functioning of the firm in the economy and forces governing the production of economic goods. Emphasis is on using economic analysis in managerial decision making. *Preq:* M B A 803 or equivalent or consent of instructor.

**M B A 803 Statistical Analysis of Business Operations 3(3,0)** Provides breadth and depth in the application of statistical techniques building on basic statistical knowledge gained in M B A 818. Topics include analysis of variance, simple and multiple regression analysis, forecasting, and non-parametric statistics. *Preq:* M B A 818 or equivalent or consent of instructor.

**M B A 804 Managerial Accounting and Information Systems 3(3,0)** Preparation, analysis, interpretation, and use of accounting information in the guidance and control of a business enterprise. Case material and problems are used. *Preq:* M B A 819 or equivalent or consent of instructor.

**M B A 805 Enterprise, Government, and the Public 3(3,0)** Regulatory environment of business and how it evolves. Through use of economic logic and business cases, students are equipped to understand the all-pervading nature and importance of government regulation in the economy.

**M B A 806 Operations Management 3(3,0)** How firms create value and how decisions in the areas of capacity, facilities, technology, vertical integration, workforce, quality, production planning/materials control, and organization influence a firm's ability to add value; decisions and analysis tools used for these decisions. *Preq:* M B A 818 and 830, or equivalent, or consent of instructor.

**M B A (FIN) 807 Financial Management 3(3,0)** Theory of financial management as it relates to the financial problems faced by business concerns. Concepts developed are used to assess the validity of emerging formalized techniques for improving decision making in the financial area. Topics include financial planning, short- and long-term fund raising, capital budgeting, the administration of working capital, recapitalization, listing of securities, and reorganization. Case material and problems are used. *Preq:* M B A 804 or 854 or equivalent, and M B A 803 or 853 or equivalent.

**M B A 808 Managerial Problems in Marketing 3(3,0)** Major decisions facing marketing executives and top management in their attempt to harmonize the objectives and resources of the organization with the opportunities found in the marketplace; recent theoretical developments in marketing and related disciplines and their application in management. Readings, case analysis, and discussions are used. *Preq:* M B A 829 or equivalent and M B A 803, 804, 807; or consent of instructor.

**M B A (MGT) 809 Organizational Behavior and Human Resources Management 3(3,0)** See MGT 809.

**M B A 810 Managerial Policy 3(3,0)** Decisions involved in the establishment of managerial policy. Problems, resources, and alternative courses of action are analyzed and discussed relative to the selection of company objectives and the most feasible means for achieving company goals. Integrates material and treats the coordination of the affairs of the firm as a whole. Case studies are emphasized. Should be completed as the final course in the program. *Preq:* M B A 806, 807, 808, 809.

**M B A 811 International Business Management 3(3,0)** Survey and analysis of managerial theory and the practice of international business, including the influence of cultural, economic, political, and financial factors affecting the management of the firm. Case studies of companies engaged in international business are discussed.

**M B A (FIN) 812 Financial Markets and Institutions 3(3,0)** Topics critical to the proper management of financial institutions including financial regulations, financial security types and their yields, interest rate theories, interest rate risk management, foreign currency risk management, stock index futures, and numerous operating functions in banking. *Preq:* M B A (FIN) 807 or consent of instructor.

**M B A 814 Directed Research in Quantitative Analysis 3(3,0)**

**M B A 815 Directed Research in Qualitative Analysis 3(3,0)**

**M B A 817 Business Forecasting Techniques and Applications 3(3,0)** Forecasting techniques and their application for developing and assessing forecasts. Topics include economic data sources, multiple regression and time series analysis, and interpretation of forecasts for management and other clients. *Preq:* M B A 802 and 803, or equivalent.

**M B A 818 Introduction to Business Statistics 2(2,0)** Introduction to probability concepts and distributions, sampling, estimation, and hypothesis testing involving one and two populations. May not be taken for credit toward any graduate degree. *Preq:* Consent of MBA director.



**M B A 819 Introduction to Accounting and Finance 3(3,0)** Basic concepts of accounting and finance with emphasis on using financial data for decision making; measuring, processing, reporting, and analysis of financial information; use of discounted cash flow analysis in valuation and the measurement of risk and return. Designed for MBA students lacking background in accounting and finance. *Preq:* Consent of MBA director.

**M B A (MKT) 824 Management of Sales Operations 3(3,0)** The sales function as an element of marketing strategy; the field of professional sales management; concepts and tools useful to managers at different levels of the sales organization. *Preq:* Principles of marketing or equivalent or consent of instructor.

**M B A (MKT) 825 Advertising and Promotional Management 3(3,0)** Role of promotion in the marketing mix emphasizing the types of decisions and decision areas affiliated with promotional planning. Students are exposed to and apply topics such as objective setting, budgeting, media planning and scheduling, and societal/economic impact of promotion. *Preq:* Principles of marketing or equivalent or consent of instructor.

**M B A (MKT) 826 Business Marketing 3(3,0)** Strategic marketing as it applies to industrial, organizational, and institutional markets; consumer marketing versus business-to-business marketing; current business marketing literature and practices. *Preq:* Principles of marketing or equivalent or consent of instructor.

**M B A (MKT) 828 Services Marketing 3(3,0)** Nature of services marketing and the special requisites that distinguish successful services marketing from goods marketing. Topics include promoting and making the service tangible, designing optimal service operations, the ideal service worker, pricing of services and critical points of services delivery. *Preq:* Principles of marketing or equivalent or consent of instructor.

**M B A 829 Marketing Foundations 2(2,0)** Principles and concepts involved in planning, pricing, promoting, and distributing goods and services. *Preq:* Consent of MBA director.

**M B A 830 Managerial Decision Modeling 2(2,0)** Introduction to basic decision modeling techniques useful in managerial decision making, including linear programming, project management, and Monte Carlo simulation. May not be taken for credit toward any graduate degree. *Preq:* Consent of MBA director.

**M B A (FIN) 832 International Financial Management 3(3,0)** Factors that influence the financial management of multinational corporations. Topics include international parity conditions, currency exposure management, capital budgeting of international projects and political risks. *Preq:* M B A (FIN) 807 or 857 or consent of instructor.

**M B A (FIN) 835 Investment Management 3(3,0)** Current techniques and strategies in the analysis of various investment alternatives; portfolio management with an introduction to options and futures markets. *Preq:* Principles of accounting and a demonstrated proficiency in basic finance.

**M B A (FIN) 836 Real Estate Principles 3(3,0)** Advanced survey course to acquaint students with the theories, practices, and principles of real estate. Topics include urban economics, real estate law, brokerage, real estate valuation, financial institutions, tax issues, investment analysis, and development. *Preq:* M B A (FIN) 807 or 819 or consent of instructor.

**M B A 837 Legal Environment of Business 2(2,0)** Legal and case analysis of court systems and dispute resolution, contracts, business torts, EEOC, Age Discrimination in Employment Act, Americans with Disabilities Act, Employment-at-Will compared to union participation; international legal considerations as these topics relate to business concerns. May not be used for credit toward a graduate degree. *Preq:* Consent of MBA director.

**M B A 838 Law in the Business Environment 1(1,0)** Legal analysis of contracts, business torts, EEOC, American Discrimination in Employment Act, Americans with Disabilities Act, Employment-at-Will as compared to union participation and an overview of international legal considerations as these topics relate to business concerns. *Preq:* Consent of MBA director.

**M B A 839 Business Negotiations and Legal Dispute Resolution 3(3,0)** Negotiation and dispute resolution in the business environment. Negotiation techniques and practices, negotiation team building, international negotiation issues, as well as alternative dispute resolutions as applied to legal issues within the business environment. *Preq:* M B A 837, 838 or consent of instructor.

**M B A (MGT) 845 Technology and Innovation Management 3(3,0)** Interdisciplinary examination of problems and issues in integrating technology and innovation into processes and products; evaluating tangible and intangible aspects of new technology adoption; management research and development; and functional integration of marketing and operations.

**M B A 846 Use of Derivatives in Financial Engineering 3(3,0)** The valuation and use of basic derivative securities such as futures and options; the financial engineering of securities combinations such as swaps, spreads, and straddles; applications of derivatives and financial engineering in managing financial risks. *Preq:* M B A 807 or 867 or consent of instructor.

**M B A 850 Business Communications 1(1,1)** Techniques, skills, problems, and approaches for effective business communications; strengths and weaknesses of various communications forms with concentration on informative and persuasive models. Approaches include practical experience in written work and presentations, video and verbal feedback, teamwork, problem solving, and situational presentations. *Preq:* Consent of MBA director.

**M B A 853 Statistical Analysis for Business 3(3,0)** Application of modern statistical inference in business operations. Topics include testing statistical hypotheses, consequences of making decisions with incomplete information, univariate and multivariate regression with emphasis on business applications, and design of experiments and analysis of variance with special attention given to efficient and relevant data collection and interpretation. Offered fall semester only. *Preq:* Consent of MBA director.

**M B A 854 Managerial Accounting 3(3,0)** Analysis, interpretation, and use of accounting information for planning and control in business and non-business organizations; profit planning, budgeting and standards; product and segment costing and evaluation; case studies and computer-based assignments. Offered spring semester only. *Preq:* M B A 819 or equivalent or consent of instructor.

**M B A 856 Operations Management 3(3,0)** Strategic and tactical issues involved in the design, planning, and control of the operating system in service and manufacturing organizations. Topics include operations strategy, process choice, facility design, planning and scheduling, and methods for continuous improvement. Offered spring semester only. *Preq:* M B A 853 or consent of instructor.

**M B A 858 Managerial Marketing 3(3,0)** Key marketing concepts and theories with extensive application to a broad range of business and not-for-profit situations; analysis of marketing opportunities and threats, researching and selecting target markets, and developing and comparing marketing strategies to prepare students to develop advanced marketing strategies. Offered fall semester only. *Preq:* M B A 853 or consent of instructor.

**M B A 859 Management Science Applications 3(3,0)** Management science techniques and their application to a wide range of managerial decisions. Topics include queuing models, linear programming, transportation problems, and simulation. *Preq:* Consent of MBA director.

**M B A (MKT) 860 Advanced Marketing Strategy 3(3,0)** Advanced marketing theory and critical thinking skills applied to support strategic decision making. Data analysis and advanced marketing models are employed with emphasis on building analytic and assessment skills. Offered spring semester only. *Preq:* M B A 858 or MKT 865 or consent of instructor.

**M B A (MGT) 861 Information Systems 3(3,0)** See MGT 861.

**M B A 862 Managerial Economics 3(3,0)** Use of economic analysis in managerial decision making. Topics include the theory of cost, production, industrial organization, coordination, and control of the firm, from theoretical concepts to actual decision making. Offered fall semester only. *Preq:* Consent of MBA director.

**M B A 863 Advanced Managerial Economics 3(3,0)** Advanced economic analysis for managerial decision making. Topics include advanced price theory, theory of firm, internal organization of the firm, the economics of strategic behavior in the market, and the empirical estimation of demand and cost functions. *Preq:* M B A 862 or consent of instructor.

**M B A 870 Strategic Management 3(3,0)** Ongoing process of positioning a firm for competitive advantage in its changing business environment focusing on the role of general managers in formulating and implementing strategies for single and multibusiness firms. Business cases, class discussions, and group projects are used to integrate content from previous business courses. Offered spring semester and summer session only. *Preq:* M B A 807, 809, 838, 854, 856, 861, 862; or consent of instructor.



**M B A 871 Programming and System Development 3(3,0)** Programming concepts and structures in developing information systems applications. Specific techniques and tools covered are updated to incorporate the newest technologies. *Preq:* Consent of instructor.

**M B A 872 Entrepreneurial Finance 3(3,0)** Business valuation, financial forecasting, financing strategies, and business harvesting; case studies and computer modeling. *Preq:* ECON 855 or M B A 807.

**M B A (MGT) 874 Managing Continuous Improvement 3(3,0)** See MGT 874.

**M B A 875 Enterprise Development 3(3,0)** Entrepreneurial process from conception to birth of new venture emphasizing discovery, searching for opportunities, and gathering resources to convert opportunities to businesses. Students learn how to evaluate entrepreneurs and their plans by working in teams to write a business plan for a new venture.

**M B A 876 Electronic Marketing 3(3,0)** Application of the concepts and theories of marketing to e-commerce, challenges facing marketing in business-to-business and business-to-consumer contexts, strategic application of marketing mix variables in e-business environment. *Preq:* Consent of instructor.

**M B A 880 MBA Seminar 1(1,0)** Exposure to various career fields for MBA students through a mix of outside speakers, workshops, field trips, and other activities related to career development. May be repeated for a maximum of four credits. To be taken Pass/Fail only. *Preq:* Consent of instructor.

**M B A 888 Internship in Business Administration 1-3** Preplanned, preapproved, faculty-supervised internship designed to give students on-the-job learning in support of classroom education. Internships must be no less than ten full-time, consecutive weeks with the same internship provider. May be repeated for a maximum of three credits. *Preq:* Thirty semester hours of graduate credit and consent of MBA director.

**M B A 899 Selected Topics in Business Administration 3(3,0)** Current topics in business administration as they relate to the manager. Topics may come from a single functional area or may integrate two or more functional areas (accounting, economics, finance, management, or marketing). May be repeated for a maximum of nine credits.

## CAREER AND TECHNOLOGY EDUCATION

**CTE (ED) 700 Supervising the Student Teacher in the Public School 2-3(2-3,0)** See ED 700.

**CTE 815 Seminar in Industrial Education 1(1,0)** Students and faculty discuss and study new technological and professional advances. May be repeated for a maximum of three credits. To be taken Pass/Fail only.

**CTE 820 Recent Process Developments 3(3,0)** Recent technological innovations, inventions, processes, and products and their impact on our industrial, labor, educational, and social institutions.

**CTE (H R D) 845 Needs Assessment for Education and Industry 3(3,0)** See H R D 845.

**CTE (H R D) 846 Applied Public Relations 3(3,0)** See H R D 846.

**CTE (H R D) 847 Instructional Systems Design 3(3,0)** See H R D 847.

**CTE 851 Current Topics in Communication Technology 1-3(1-3,0)** Recent technological processes in the communication industry such as CAD, desktop publishing, and interactive video for teachers and industrial personnel.

**CTE 852 Current Topics in Manufacturing Technology 1-3(1-3,0)** Contemporary manufacturing practices for public school teachers and industry personnel.

**CTE 853 Current Topics in Construction Technology 1-3(1-3,0)** Update for teachers in industrial technology education programs at the secondary level, instructors in construction-related programs at the postsecondary level, and industrial trainers in the private sector; contemporary technological processes in construction industries.

**CTE 854 Current Topics in Power Technology 1-3(1-3,0)** Contemporary applications of power and energy for public school teachers and industry personnel.

**CTE (H R D) 860 Instructional Materials Development 3(3,0)** See H R D 860.

**CTE 865 American Industries 3(3,0)** Concepts and principles of American industry and technology. Industrial plant visits supplement study of industrial organization, economics, management, production, and products.

**CTE (H R D) 870 Consulting for Education and Industry 3(3,0)** See H R D 870.

**CTE (AG ED, ED) 889 Research in Education 3(3,0)** See AG ED 889.

**CTE 894 Project Research 1-6(1-6,0)** Research related to departmental projects. Open only to students planning to pursue advanced graduate study. Joint use with CTE 895, 896 is not permitted for degree.

**CTE 895 Special Problems I 3(3,0)** Special problems in industrial education varying with interests, experiences, and needs of students. *Preq:* Submission of a written proposal, completion of nine hours in the major, and consent of advisor.

**CTE 896 Special Problems II 3(3,0)** Continuation of CTE 895. *Preq:* CTE 895, written proposal, and consent of advisor.

## CERAMIC AND MATERIALS ENGINEERING

**C M E 602 Solid State Materials 3(3,0)** Discussion of the properties of solids as related to structure and bonding with an emphasis on electronic materials. Band structure theory, electronic and optical properties are treated. *Preq:* C M E 326, MTHSC 208, PHYS 221.

**C M E 616 Electrical Properties of Materials 3(3,0)** Covers a range of topics dealing with electrical and magnetic materials. Topics include metal and polymer conductors, insulators, ceramic and polymer materials for dielectric applications, and ferroelectric, piezoelectric, pyroelectric, and electrooptic materials. Metal and ceramic magnetic materials are also discussed.

**C M E 618 Process Control 3(3,0)** Process control techniques and apparatus with emphasis on temperature measurement and control systems. Application of laboratory techniques to the control of product quality and process efficiency is included. *Preq:* C M E 303, 330, 361.

**C M E 624 Optical Materials and Their Applications 3(3,0)** Introduces the interaction of materials with light. Specific topics include fundamental optical properties, materials synthesis, optical fiber and planar waveguides, and the componentry and systems-level aspects of optical communication systems. *Preq:* C M E 402, 413.

**C M E 625 Micromechanical Behavior of Materials 3(3,0)** Considers advanced concepts of microstructure-deformation-fracture interrelationships in engineering materials. *Preq:* C M E 320, 342.

**C M E 631 Advanced Ceramic Processing 3(3,0)** Advanced study of ceramic forming processes. Focuses on the many types of ceramic forming processes, such as slip casting, extrusion, dry pressing, filter pressing, and plastic forming. *Preq:* C M E 330.

**C M E 660 Metals and Their Composites 3(3,0)** Examines the control of microstructure-property relationships in metallic materials and their composites through development and selection of appropriate thermal processing procedures. *Preq:* C M E 322, 342.

**C M E (BIO E) 680 Research Principles and Concepts 1(1,0)** See BIO E 680.

**C M E 690 Special Topics in Ceramic Engineering 1-3(1-3,0)** Study of topics not ordinarily covered in other courses. Taught as the need arises. Typical topics could include current research in a specific area or technological advances. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**C M E 701 Special Problems 1-3(1-3,0)** Practical problems in ceramic engineering analysis or design. Students are assigned individual problems with topics varying from year to year in keeping with developments, interests, and experience of students and instructor. May be repeated for credit.

**C M E 800 Ceramic and Materials Engineering Seminar 1(1,0)** Discussions and presentations of current topics of ceramic science and engineering by students, faculty members, and guest speakers. Required of all graduate students. To be taken Pass/Fail only.

**C M E 809 High-Temperature Materials 3(3,0)** Properties of oxides, carbides, nitrides, borides, and silicides; obtainment and measurement of high temperatures; measurement of properties at high temperatures.

**C M E 815 Colloidal and Surface Science 3(3,0)** Theory and application of colloidal and surface chemistry to ceramic materials and processes.

**C M E 816 Constitution and Structure of Glasses 3(3,0)** Modern concepts of glass structure and properties.

**C M E 821 X-ray Diffractometry 3(2,3)** Theory and application of powder X-ray diffractometry to ceramic and materials problems.

**C M E 822 Scanning Electron Microscopy 3(2,3)** Theory and application of scanning electron microscopy to ceramic and materials problems.



**C M E 823 Transmission Electron Microscopy 3(2,3)** Advanced course in electron microscopy for materials science incorporating all aspects of transmission techniques: basics, diffraction, imaging, and spectrometry. *Preq:* C M E 821 and 822 or consent of instructor.

**C M E 825 Magnetic and Electrical Ceramic Materials 3(3,0)** Application of magnetic and electrical theory to ceramic insulators, semiconductors, and ferroelectric and ferromagnetic products.

**C M E 890 Selected Topics 1-3(1-3,0)** Topics not covered in other courses emphasizing current literature and results of current research. Topics vary from year to year to keep pace with developments. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.

**C M E 891 Master's Thesis Research 1-12**

**C M E 991 Doctoral Dissertation Research 1-12**

## CHEMICAL ENGINEERING

**CH E 601 Transport Phenomena 3(3,0)** Mathematical analysis of single and multidimensional steady-state and transient problems in momentum, energy, and mass transfer. Both the similarities and differences in these mechanisms are stressed. *Preq:* CH E 312, MTHSC 208.

**CH E 612 Polymer Engineering 3(3,0)** Design-oriented course in synthetic polymers. Topics include reactor design used in polymer production, effect of step versus addition kinetics on reactor design, epoxy curing reactions, polymer solubility, influence of polymerization and processing conditions on polymer crystallinity. *Preq:* CH 224 and 332 or consent of instructor.

**CH E (B E) 628 Biochemical Engineering 3(3,0)**  
See B E 628.

**CH E 645 Selected Topics in Chemical Engineering 3(3,0)** Topics not covered in other courses, emphasizing current literature, research, and practice of chemical engineering. Topics vary from year to year. May be repeated, but only if different topics are covered. *Preq:* Consent of instructor.

**CH E 650 Chemical Reaction Engineering 3(3,0)** Review of kinetics of chemical reactions and an introduction to the analysis and design of chemical reactors. Topics include homogeneous and heterogeneous reactions, batch and continuous flow reaction systems, catalysis, and design of industrial reactors. *Preq:* CH E 312, 321, CH 332.

**CH E 803 Advanced Transport Phenomena 3(3,0)** Analysis of heat, mass, and momentum transfer; derivation and application of the governing equations; solution of steady and unsteady-state multidimensional problems in fluid flow, heat transfer, and mass transfer.

**CH E 804 Chemical Engineering Thermodynamics 3(3,0)** First and second laws for multicomponent, unsteady-state processes; thermodynamic mixture properties from volumetric data and equations of state; excess property models; phase-equilibrium thermodynamics, including vapor-liquid, liquid-liquid, and solid-liquid equilibrium calculations for conventional systems; associating fluids, polymers, and electrolytes and reaction-equilibrium thermodynamics for multiple-reaction heterogeneous systems.

**CH E 805 Chemical Engineering Kinetics 3(3,0)** Kinetics of chemical reactions, particularly in design and operation of chemical reactors.

**CH E (EE&S) 814 Applied Numerical Methods in Process Simulation 3(3,0)** Numerical solution techniques as applied to chemical process systems; finite difference techniques for partial differential equations stressing applied numerical methods rather than theoretical numerical analysis. Standard methods for ordinary differential equations are reviewed. *Preq:* Consent of instructor.

**CH E 818 Polymer Processing 3(3,0)** Processing of polymeric materials; polymer flow characterization; extrusion; mixing; filtration; injection molding; fiber and film formation; physical science principles such as fluid flow, heat transfer, crystallization, and rheology applied to polymer processing operations.

**CH E 819 Viscoelastic Properties of Polymers and Polymeric Composites 3(3,0)** Time- and frequency-dependent behavior of structural polymers and their composites; interrelationship between various viscoelastic properties; influence of aging; prediction of composite viscoelastic response by application of the Viscoelastic Correspondence Principle. *Preq:* Consent of instructor.

**CH E 823 Mass Transfer and Stagewise Contact Operations 3(3,0)** Stagewise contact operations emphasizing distillation; vapor-liquid equilibria; integral and differential distillation; binary and multicomponent rectification; analytical methods; batch rectification; azeotropic and extractive distillation.

**CH E 834 Advanced Chemical Engineering Thermodynamics 3(3,0)** Classical and statistical thermodynamics applied to problems in chemical engineering with emphasis on modern methods of predicting thermophysical properties of gases and liquids. Students' and instructor's interests influence course content but usually include fundamentals of applied statistical mechanics, molecular theory of dense fluids, descriptions of intermolecular forces, gas-liquid and liquid-liquid critical phenomena, theories of interfacial phenomena and adsorption, statistical mechanics of polymeric systems, statistical mechanics of polydispersed systems, computer simulation of fluids by Monte Carlo, molecular dynamics, and stochastic dynamics methods. *Preq:* CH E 804 or equivalent.

**CH E 845 Selected Topics in Chemical Engineering 3(3,0)** Topics not covered in other courses emphasizing current literature and results of current research. Topics vary from year to year to keep pace with developments. May be repeated for credit.

**CH E 890 Special Projects 1-6** Comprehensive analytical and/or experimental treatment of phenomena of current interest in chemical engineering emphasizing modern technological problems. May be repeated for maximum of six credits. To be taken Pass/Fail only. *Preq:* Consent of instructor and department chair.

**CH E 891 Master's Thesis Research 1-12**

**CH E 895 Chemical Engineering Graduate Seminar 1(1,0)** Series of weekly, one-hour seminars given by students, faculty, and guests on topics of current interest. Credits earned in this course do not apply to nor alter the required minimum of six research hours for the MS degree or the required 30 research credit hours for the PhD degree. To be taken Pass/Fail only.

**CH E 945 Selected Topics in Chemical Engineering 3(3,0)** More comprehensive study of topics first covered in CH E 845.

**CH E 991 Doctoral Dissertation Research 1-12**

## CHEMISTRY

**CH 602 Inorganic Chemistry 3(3,0)** Basic principles of inorganic chemistry are discussed with special emphasis on atomic structure, chemical bonding, solid state, coordination chemistry, organometallic chemistry, and acid-base theories. The chemistry of certain selected elements is treated. Offered fall semester only. *Preq:* CH 331, 332.

**CH 611 Instrumental Analysis 3(3,0)** Principles of operation and application of modern chemical instrumentation in the field of analytical chemistry. Topics include basic electronics, statistics, optical, mass, magnetic resonance, electron and x-ray spectroscopies, radiochemistry, and separation science. *Preq:* CH 331, 332.

**CH 621 Advanced Organic Chemistry 3(3,0)** Survey of modern organic chemistry with an emphasis on synthesis and mechanisms. *Preq:* CH 224, 332 or equivalent.

**CH 625 Medicinal Chemistry 3(3,0)** Survey of the pharmaceutical drug discovery process. Covers discovery of candidate compounds; bioassay methods; associated regulatory and commercial issues. Case studies are selected from the current literature. *Preq:* CH 224 or equivalent or consent of instructor.

**CH 627 Organic Spectroscopy 3(2,3)** Survey of modern spectroscopic techniques used in the determination of molecular structure. Emphasis is on the interpretation of spectra: nuclear magnetic resonance, ultraviolet, infrared, mass spectroscopy, optical rotatory dispersion and circular dichroism. *Preq:* One year each of organic chemistry and physical chemistry.

**CH 635 Atomic and Molecular Structure 3(3,0)** Introduction to quantum theory and its application to atomic and molecular systems. Topics include harmonic oscillator, hydrogen atom, atomic and molecular orbital methods, vector model of the atom, atomic spectroscopy, and molecular spectroscopy. Offered spring semester only. *Preq:* CH 332 or consent of instructor.

**CH 651 Frontiers in Polymer Chemistry 3(3,0)** Survey of selected areas of current research in polymer science with particular emphasis on polymer synthesis. Although a text is required for review and reference, course is primarily literature based and focused on areas of high impact to multidisciplinary technology. *Preq:* CH 223, 224, PTC 415 or consent of instructor.



- CH 671 Teaching Chemistry 3(3,0)** Topics in chemistry addressed in the context of constructivist methodologies. Laboratory work and management, laboratory safety, and the use of technology in the chemistry classroom are also considered. *Preq:* 300-level chemistry course or high school teaching experience or consent of instructor.
- CH 704 Selected Topics for Chemistry Teachers 1-6(1-6,1-6)** Directed individual study in designing experiments and teaching materials or an in-depth study of one or more advanced topics. For graduate students in Elementary and Secondary Education. May be repeated, but only if different topics are covered. Offered spring semester of odd-numbered years only.
- CH 800 Professional Development Issues in Chemistry 1(1,0)** Covers development of professional behavior for graduate students in chemistry, including communication skills, teaching techniques, research ethics, career management, "grantsmanship," and intellectual property issues in science. *Preq:* Graduate standing in Chemistry.
- CH 805 Theoretical Inorganic Chemistry 3(3,0)** Application of group theory to structure and properties of inorganic molecules. Offered spring semester of odd-numbered years only. *Preq:* CH 435 and 804 or consent of instructor.
- CH 806 Physical Methods in Inorganic Chemistry 3(3,0)** Theory and application of infrared, Raman, visible, ultraviolet, NMR, ESR, NQR, Mössbauer, and mass spectrometry to inorganic chemistry. Offered spring semester of odd-numbered years only. *Preq:* CH 804 or consent of instructor.
- CH 807 Chemistry of the Transition Elements 3(3,0)** Structure, spectroscopy, and reactivity of transition metals and their compounds. Offered fall semester only. *Preq:* CH 804 or consent of instructor.
- CH 808 Chemistry of the Nonmetallic Elements 3(3,0)** Development and application of a bonding model for descriptive inorganic chemistry of boron, carbon, silicon, nitrogen, phosphorus, oxygen, and sulfur. Offered spring semester of odd-numbered years only. *Preq:* CH 804 or consent of instructor.
- CH 809 Chemical Applications of X-Ray Crystallography 3(2,2)** Physical description of the crystalline state, symmetry in crystals, X-ray diffraction, modern methods of structure determination, and chemical interpretation of structural results. Offered spring semester of odd-numbered years only. *Preq:* CH 331 and 332 or consent of instructor.
- CH 811 Analytical Chemistry 3(3,0)** Graduate-level review of modern analytical chemistry; literature, sampling, quality control/assurance, chemometrics, and the use of modern analytical methods; team taught by the analytical faculty. Offered fall semester only.
- CH 812 Chemical Spectroscopic Methods 3(2,3)** Emission and absorption spectroscopy, chemical microscopy, X-ray diffraction, and fluorescence techniques in analytical chemistry; theory and operation of instruments.
- CH 813 Electrochemical Science 3(3,0)** Theory and experimental study of electrochemical thermodynamics, electrified interfaces, interfacial charge transfer, electrolyte solutions, electrode processes, and membrane electrochemistry; amperometric, voltammetric, electrolytic, and potentiometric methods; practical applications of electrochemistry in analysis, materials synthesis and energy technology. *Preq:* Graduate standing in Chemistry or Chemical Engineering or consent of instructor.
- CH 816 Separation Science 3(3,0)** Fundamental thermodynamic and kinetic concepts of separation and practical aspects of current separation techniques used in analytical chemistry. Offered spring semester of odd-numbered years only.
- CH 818 Surface and Thin Film Analysis 3(2,2)** Fundamental principles underlying the most commonly employed techniques for surface and thin films analysis. Representative techniques include atomic force microscopy, scanning electron microscopy, secondary ion mass spectrometry, Auger electron spectroscopy, and Rutherford backscattering. Laboratory exercises give insights into analytical methods.
- CH 820 Fundamentals of Organic Synthesis 3(3,0)** Modern aspects of organic chemistry emphasizing the mechanisms of reactions and synthesis of molecules of current interest. Offered fall semester only. *Preq:* CH 224 or equivalent plus satisfactory performance in the organic placement examination or consent of instructor.
- CH 821 Organic Chemistry I 3(3,0)** Theoretical concepts of organic chemistry, stereochemistry, and mechanisms of organic reactions. Offered fall semester only. *Preq:* CH 421 or satisfactory performance on the organic chemistry placement examination.
- CH 822 Organic Chemistry II 3(3,0)** Continuation of CH 821; mechanisms of organic reactions including photochemistry and Woodward-Hoffman rules; modern synthetic organic chemistry. Offered spring semester only. *Preq:* CH 821 or consent of instructor.
- CH 825 Chemistry of Heterocyclic Compounds 3(3,0)** Chemistry of heterocyclic compounds of nitrogen, oxygen, sulfur, and other elements. Offered spring semester of odd-numbered years only. *Preq:* CH 821, 822, or consent of instructor.
- CH 830 Fundamentals of Physical Chemistry 3(3,0)** Principles of classical thermodynamics, chemical kinetics, and quantum chemistry. Offered fall semester only. *Preq:* CH 331 or equivalent.
- CH 831 Chemical Thermodynamics 3(3,0)** Classical thermodynamics emphasizing theory and significance of energetics and systems of variable composition. Offered fall semester of odd-numbered years only. *Preq:* CH 331 or equivalent.
- CH 834 Statistical Thermodynamics 3(3,0)** Statistical thermodynamics: ensemble method, ideal gases, internal degrees of freedom, solid state, imperfect gases, distribution function method in fluids, and time-dependent fluctuations. *Preq:* CH 831.
- CH 835 Chemical Kinetics 3(3,0)** Rate processes and reaction mechanisms; order of reaction; theory of rate processes; relation of reaction rates to mechanism; homogeneous and heterogeneous catalysis; experimental methods; chain reactions; diffusion; effects of solvent, temperature, and pressure on reaction rates and mechanisms. Lectures are supplemented by assigned problems, paper, and oral examination of topic of special interest to the student. Offered spring semester of odd-numbered years only.
- CH 837 Quantum Chemistry 3(3,0)** Mathematical and conceptual formulation of quantum theory of electronic structure of atoms and molecules; eigenvalue solution of one-dimensional Schrödinger equation and application of this method to chemical problems. Offered fall semester of odd-numbered years only.
- CH 838 Computational Chemistry 3(3,0)** Theoretical methods and software used in computational chemistry; quantum chemical methods including molecular orbital methods and density functional theory; classical simulation techniques including potential energy functions, molecular mechanics, molecular dynamics, and Monte Carlo. Advanced topics vary with interests of students. *Preq:* CH 331 and 332 or equivalent.
- CH 840 Techniques of Experimental Chemistry 3(1,6)** Theory and practice in major experimental techniques used in chemical research; chromatography; NMR, IR, visible, UV, and ORD/CD spectrophotometry; glassblowing and high vacuum techniques; mass spectrometry; ESR; Mössbauer spectrometry and tracer analysis.
- CH 841 Chemical Applications of NMR Spectroscopy 3(2,2)** Basic concepts of NMR spectroscopy with application to organic, inorganic, physical, and analytical chemistry; design of spectroscopic experiments and interpretation of spectra; modern techniques including multipulse, multinuclear, and two-dimensional methods. Offered fall semester only. *Preq:* CH 331 and 332 or consent of instructor.
- CH 851 Graduate Student Seminar 1-2(1-2,0)** Students and faculty review current topics in chemistry. May be taken more than one semester.
- CH 852 Departmental Seminar 1-2(1-2,0)** Off-campus speakers are invited to present aspects of their research to the chemistry faculty and graduate students every week during the academic year. Some of these talks may form the basis for cumulative examination questions. Attendance is mandatory. May be taken more than one semester. *Preq:* Approved bachelor's degree.
- CH 891 Master's Thesis Research 1-12**
- CH 900 Selected Topics in Inorganic Chemistry 1-4(1-4,0)** Metal-metal bonding; homogeneous catalysis; photochemistry; bioinorganic chemistry; solid state chemistry. Topics vary with interests of students. May be repeated for credit if different topics are covered.
- CH 910 Selected Topics in Analytical Chemistry 1-4(1-4,0)** New techniques and their applications in analytical chemistry; laser methods; data acquisition processing; electronics, instrument/computer interfacing; field methods of sampling and analysis. Topics vary with interests of students. May be repeated for credit, but only if different topics are covered.



**CH 920 Selected Topics in Organic Chemistry 1-4(1-4,0)** Heterocyclic compounds; stereochemistry; natural products; organometallic chemistry; photochemistry. Topics vary with interests of students. May be repeated for credit, but only if different topics are covered.

**CH 930 Selected Topics in Physical Chemistry 1-4(1-4,0)** Special problems in molecular spectroscopy, molecular orbital treatments, applications of group theory to chemical structure, irreversible thermodynamics, and special topics in statistical mechanics. Topics vary with interests of students. May be repeated for credit, but only if different topics are covered.

**CH 991 Doctoral Dissertation Research 1-12**

## CITY AND REGIONAL PLANNING

**C R P 601 Introduction to City and Regional Planning 3(3,0)** Introduces students from other disciplines to City and Regional Planning. Spatial and nonspatial areas of discipline are explored through a wide ranging lecture/seminar program. *Preq:* Consent of instructor.

**C R P 602 Human Settlement 3(3,0)** Overview of forces and trends affecting community growth and change—historical, ecological, economic, demographic, design, and development—pertaining to human settlement patterns and their interrelationship in the urbanization process, especially at the national, regional, townscape, and neighborhood scale. Team-taught from various perspectives. Intended as a foundation core course for Master's in Real Estate Development, City and Regional Planning, and Landscape Architecture. *Preq:* Consent of instructor.

**C R P 603 Seminar on Planning Communication 3(3,0)** In-depth analysis of methods to communicate planning and policy decisions effectively; attempts to familiarize students with the various communication skills needed by planners, policy-makers, and other professionals to become successful practitioners. *Preq:* Consent of instructor.

**C R P (C E) 612 Urban Transportation Planning 3(3,0)** See C E 612.

**C R P 634 Geographic Information Systems for Landscape Planning 3(1,6)** Develops competence in geographic information systems technology and its application to various spatial analysis problems in landscape planning. Introduces basic principles of GIS and their use in spatial analysis and information management. Topics include database development and management, spatial analysis techniques, cartography, critical review of GIS applications, and hands-on projects.

**C R P 801 Planning Process and Legal Foundations 3(3,0)** Introduction to city and regional planning profession and related processes with the legal foundation for comprehensive planning and tools of implementation. *Preq:* Consent of instructor.

**C R P 802 Site Planning and Infrastructure 3(2,3)** Working knowledge of natural systems and infrastructure systems as they affect site planning and development. *Preq:* Consent of instructor.

**C R P 803 Quantitative Analysis 4(2,6)** Basic tools of quantitative analysis and planning methods in the context of analytical, procedural, and institutional needs of the planner. Students learn data collection, analysis, and interpretation of different planning problems. Emphasis is placed on understanding the logic of statistical analysis, methods of planning analysis, and policy formation. *Preq:* Consent of instructor.

**C R P 804 Land Use Analysis and Assessment 4(2,6)** Introduction to basic methods of land use planning including land suitability analysis, land market forecasts, and formulating alternative land use plans. Development impact assessment and project appraisal methods are introduced to evaluate land use plans. *Preq:* C R P 803.

**C R P 805 Planning Theory and History 3(3,0)** Development of the planning practice and theories of planning process: historical evolution of planning practice in the U.S., social issues in planning, theories of planning and critiques of those theories, and ethical issues in planning practice. *Preq:* Consent of instructor.

**C R P 806 Urban Systems and Growth Management 3(3,0)** Overview of basic principles of resource allocation including public finance and project appraisal techniques. Infrastructure planning and capital improvement plans are introduced followed by basic concepts of growth management and an overview of growth management laws and tools. Course is team-taught to address diverse subject matter. *Preq:* Consent of instructor.

**C R P 807 Professional Studio 4-6(2-3,6-9)** Serves as a vehicle for synthesis and application of skills developed in other courses and includes participation in one or more real-world planning projects in addition to seminars and readings devoted to development of professional practice skills. *Preq:* Consent of instructor.

**C R P 822 Urban Design 3(3,0)** Analysis of the evolution of the physical patterns of cities through research in the historical development of urban form in Europe and America within the context of prevailing social, economic, and political influences; approaches to the analysis of contemporary cities through the study of modern planning theorists. *Preq:* Consent of instructor.

**C R P 830 Introduction to GIS 1(1,0)** Introduces participants to ArcGIS as a tool for real estate development analysis and provides the foundation for becoming a successful GIS user. Students are introduced to fundamental GIS concepts. Topics include displaying, downloading, analyzing, and printing public domain geographical data sets. *Preq:* Consent of instructor.

**C R P 832 Problems in Site Planning 3(1,6)** Advanced site planning and design concept studies developed through site projects; concentration on industrial, residential, and recreational facilities. Emphasis is on use-specific site analysis and generation of development alternatives. *Preq:* Consent of instructor.

**C R P 834 Spatial Modeling Using GIS 3(2,3)** Use of geographic information systems (GIS) in spatial analysis, information management, and synthesis of spatial patterns and processes. Emphasizes developing an operational understanding of the modeling techniques and data used in different applications such as land use allocation, corridor location, site location and market analysis, environmental assessment, and cost-benefit analysis. *Preq:* C R P 634 or 804; or consent of instructor.

**C R P 835 GIS and Remote Sensing Applications for Trend Analysis 3(2,3)** Principles of remote sensing and land information systems in trend analysis. Addresses aspects of change detection for monitoring natural resources and urban growth. Designed for those interested in planning, natural resources management, and environmental analysis. Lectures and hands-on laboratory work emphasize the use of imagery for database generation and analysis. *Preq:* C R P 634, 804, or 834; or consent of instructor.

**C R P 840 Seminar in Coastal Planning 3(3,0)** Issues relating to development and conservation of coastal environments, focusing on inherent tradeoffs between growth and environmental quality; ecology and carrying capacity of coastal areas; appropriate management approaches to balance coastal resource demand. *Preq:* Consent of instructor.

**C R P 841 Seminar in Environmental Planning 3(3,0)** Current and emerging environmental issues and appropriate planning options, including population dynamics and limits to growth, entropy law, waste management, and global climate change; students pursue individual research on an environmental issue of particular concern and report findings. *Preq:* Consent of instructor.

**C R P (PRTM) 844 Outdoor Recreation Resource Management and Planning 3(3,0)** Issues relating to planning and development of natural areas for recreational purposes. Emphasis is on the policy-making process at the federal, state, regional, and local levels. *Preq:* Consent of instructor.

**C R P 858 Research Design 3(3,0)** Provides opportunity for students in their final year of study in the planning program to develop a proposal for the terminal project or thesis. Students are responsible for completing the research, writing, and editing necessary for an acceptable proposal. *Preq:* Consent of faculty.

**C R P 859 Planning Terminal Project 3(0,9)** Students select, with approval of advisor, and conduct research on individual planning problems of suitable scope. Oral, written and, where appropriate, visual presentations of solution are required. Students must enroll during final semester. *Preq:* C R P 858.

**C R P (PO ST) 870 Seminar in Sustainable Development 3(3,0)** See PO ST 870.

**C R P 871 Growth Management and Legal Issues 3(3,0)** Basic laws and court cases relating to the comprehensive plan, implementing tools and other aspects of the planning process in the growth management context. *Preq:* C R P 672, consent of instructor or department chair.



**C R P 872 Housing Issues in the United States 3(3,0)** Regulation, stimulation, salvage, and replacement of housing through public policy administrative procedures; specific housing programs are analyzed in detail. *Preq:* Consent of instructor.

**C R P 873 Economic Development Planning 3(3,0)** Economic development planning process, focusing on applied programmatic techniques, especially at the state, local, and neighborhood levels. Emphasis is on theoretical models, economic development process, private/public partnerships, economic development tools, political context, and economic development planning administration and organization. *Preq:* Consent of instructor.

**C R P 883 Techniques for Analyzing Development Impacts 3(3,0)** Models and techniques for analyzing development impacts in urban areas and regions; economic, fiscal, social, and environmental impact methods. Operational knowledge of these techniques is developed. *Preq:* Consent of instructor.

**C R P 889 Selected Topics in Planning 3(3,0)** Topics emphasizing current literature and results of current research. May be repeated for credit. *Preq:* Consent of instructor.

**C R P 890 Directed Studies in City and Regional Planning 1-6(0,3-18)** Students pursue individual professional interests under guidance of City and Regional Planning graduate faculty. May be repeated for credit.

**C R P 891 Planning Thesis 6(0,18)** Students, working individually, program a planning problem of appropriate scope and conduct research. Oral, written and, where appropriate, visual presentations of theses are required. To be taken Pass/Fail only. *Preq:* Consent of faculty.

**C R P 893 City and Regional Planning Internship 3(0,9)** Ten weeks of supervised professional employment with an approved planning entity. To be taken Pass/Fail only. *Preq:* Two semesters of City and Regional Planning or equivalent.

**C R P 894 Planning Internship Seminar 3(3,0)** Seminar-based analysis of student internships, enabling students to compare experiences and gain greater understanding of professional practice by reflecting on planning issues. To be taken Pass/Fail only. *Preq:* C R P 893.

## CIVIL ENGINEERING

**C E 601 Indeterminate and Matrix Structural Analysis 3(3,0)** Analysis of indeterminate structures using moment distribution, energy methods such as virtual work and Castigliano's Theorem, and the matrix formulation of the direct stiffness method. *Preq:* C E 301 or consent of instructor.

**C E 604 Masonry Structural Design 3(3,0)** Introduction to design of structural elements for masonry buildings. Lintels, walls, shear walls, columns, pilasters, and retaining walls are included. Reinforced and unreinforced elements of concrete or clay masonry are designed by allowable stress and strength design methods. Introduction to construction techniques, materials, and terminology used in masonry. *Preq:* C E 402 or consent of instructor.

**C E 607 Wood Design 3(3,0)** Introduction to wood design and engineering; properties of wood and wood-based materials; design of beams, columns, walls, roofs, panel systems, and connections. *Preq:* C E 402 or 406, or consent of instructor.

**C E 610 Traffic Engineering Operations 3(3,0)** Basic characteristics of motor-vehicle traffic, highway capacity, applications of traffic control devices, traffic design of parking facilities, engineering studies, traffic safety, traffic laws and ordinances, public relations. *Preq:* C E 311 or consent of instructor.

**C E 611 Roadway Geometric Design 3(2,3)** Geometric design of roadways, at-grade intersections, and interchanges in accordance with conditions imposed by driver ability, vehicle performance, safety, and economics. *Preq:* C E 311 or consent of instructor.

**C E (C R P) 612 Urban Transportation Planning 3(3,0)** Urban travel characteristics, characteristics of transportation systems, transportation and land-use studies, trip distribution and trip assignment models, city patterns, and subdivision layout. *Preq:* C E 311 or consent of instructor.

**C E 621 Geotechnical Engineering Design 3(3,0)** Relationship of local geology to soil formations, groundwater, planning of site investigation, sampling procedures, determination of design parameters, foundation design, and settlement analysis. *Preq:* C E 321 or consent of instructor.

**C E 624 Earth Slopes and Retaining Structures 3(3,0)** Principles of geology, groundwater and seepage, soil strength, slope stability, and lateral earth pressure and their application to the design of excavations, earth fills, dams, and earth-retaining structures. *Preq:* C E 321 or GEOL 320 or consent of instructor.

**C E 633 Construction Planning and Scheduling 3(3,0)** Principles and applications of the Critical Path Method (CPM) and Project Evaluation and Review Techniques (PERT). Project breakdown and network graphics. Identification of the critical path and resulting floats. Definition and allocation of materials, equipment, and manpower resources. Resource leveling, compression, and other network adjustments. Computer applications using packaged routines. *Preq:* C E 331 or consent of instructor.

**C E 634 Construction Estimating and Project Control 3(3,0)** Specifications, contracts, and bidding strategies; purchasing and subcontracting policies; accounting for materials, supplies, subcontracts, and labor; procedural details for estimating earthwork, reinforced concrete, steel, and masonry; overhead and profit items. *Preq:* C E 331 or consent of instructor.

**C E 638 Construction Support Operations 3(3,0)** Describes activities necessary for the completion of a construction job although not specifically recognized as direct construction activities: general conditions, safety, security, quality assurance, value engineering; organizational support features, and typical implementation procedures. *Preq:* C E 331 and EX ST 301, or consent of instructor.

**C E 646 Flood Hazards and Protective Design 3(3,0)** Study of flood hazards and methods of protective design of the built environment. Floodplain mapping and delineation. Methods for determining base flood elevations. Flood-resistant construction, flood proofing, and governmental regulations are discussed. Includes case studies and design projects. *Coreq:* C E 342 or consent of instructor.

**C E 647 Stormwater Management 3(3,0)** Evaluation of peak discharges for urban and rural basins, design of highway drainage structures such as inlets and culverts; stormwater and receiving water quality; best management practices; detention and retention ponds; and erosion and sediment control. *Preq:* C E 342. *Coreq:* EE&S 401 or consent of instructor.

**C E 648 Physical Models in Hydraulics 3(2,3)** Tools and techniques of physical modeling to aid in design of complex hydraulic systems. Students participate in construction, operation, and testing of physical models to solve hydraulic engineering design problems. Experimental design and operation are covered. *Preq:* C E 342 or consent of instructor.

**C E 649 Hydraulic Structures 3(3,0)** Design methods and procedures are taught for a variety of hydraulic structures including intake structures, complex open-channel and closed conduit control structures, transitions, spillways, small dam, and pond design. Field trips to actual hydraulic structures may be included. *Preq:* C E 342 or consent of instructor.

**C E 655 Properties of Concrete and Asphalt 3(2,3)** Properties of aggregate, concrete, and asphalt; concrete and asphalt mix designs are conducted in the laboratory. *Preq:* C E 351 and EX ST 301, or consent of instructor.

**C E 662 Coastal Engineering I 3(3,0)** Introduction to coastal and oceanographic engineering principles including wave mechanics, wave-structure interaction, coastal water-level fluctuations, coastal-zone processes, and design considerations for coastal structures and beach nourishment projects. *Preq:* C E 341 or consent of instructor.

**C E 682 Groundwater and Contaminant Transport 3(3,0)** Basic principles of groundwater hydrology and transport of contaminants in groundwater systems; groundwater system characteristics; steady and transient flow; well hydraulics, design and testing; contaminant sources, movement and transformations. *Preq:* C E 341. *Coreq:* EE&S 401.

**C E 691 Selected Topics in Civil Engineering 1-6(1-6,0)** Structured study of civil engineering topics not found in other courses. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**C E 801 Matrix and Finite Element Analysis 3(3,0)** Matrix and finite element methods in solution of engineering problems; stiffness matrices for triangular, rectangular, and quadrilateral elements in planer systems; plate bending, shell, and 3-D elements; applications to solutions of structural and soil mechanics problems using special and general purpose programs. *Preq:* C E 401 or consent of instructor.



- C E 802 Advanced Reinforced Concrete Design 3(3,0)** Second course in design of reinforced concrete structures; advanced concepts in analysis and design of beams, columns, and slabs; introduction to prestressed concrete. *Preq:* C E 402 or consent of instructor.
- C E 803 Advanced Steel Design 3(3,0)** Advanced design of structural steel buildings emphasizing the relationship between design and response of the structural system; theoretical basis of building code provisions; limit state and plastic design; beam-columns; plate girders and composite sections and connections. *Preq:* C E 406 or consent of instructor.
- C E 804 Prestressed Concrete 3(3,0)** Introduction to the analysis, behavior, and design of prestressed concrete members and structures. Allowable stress design and strength design of P/C members, shear design, loss of prestress force, design of continuous structures. *Preq:* C E 401 and 402, or consent of instructor.
- C E 805 Advanced Structural Mechanics 3(3,0)** Development and utilization of mechanics principles in solution of structural problems; unsymmetrical bending and curved beams; beams on elastic foundations; plastic structure analysis of beams and frames; eigenvalue problems; plastic stress-strain relations; strain energy; series and finite element solutions to plate and shell structures. *Preq:* C E 401 or consent of instructor.
- C E 806 Dynamic Analysis of Structures 3(3,0)** Analysis and design of structures subjected to dynamic loading; response of lumped and distributed parameter systems of one or many degrees of freedom; approximate design methods; introduction to earthquake analysis and design. *Preq:* C E 801 or consent of instructor.
- C E 807 Wind Engineering 3(2,2)** Effects of wind on buildings, bridges, and other structures; meteorological aspects of wind generation; types and characteristics of various wind events; aerodynamics of flow around structures; wind-induced loads; structural responses; design basis safety and serviceability criteria.
- C E 808 Earthquake Engineering 3(3,0)** Effects of earthquake-induced forces on buildings, bridges, and other structures; development of design codes and their application to the design of structures to resist seismic forces; fundamental structural dynamics and analysis techniques used to compute the response of structures or obtain design forces. *Preq:* C E 806 or consent of instructor.
- C E 809 Forensic Engineering 3(3,0)** Study of civil engineering failures including analyses of conditions just prior to the failure, load or event causing failure; methods of investigation and design of remedial measures; case histories of failures illustrating common errors and failures. Student projects involve design of remedial measures and alternatives.
- C E 813 Highway and Airport Pavement Design 3(3,0)** Structural design of rigid and flexible pavements; design of bases and subbases; theory of stresses and application of plate bearing, triaxial and California Bearing Ratio design methods to flexible pavements; Westergaard analysis for rigid pavements; pavement evaluation methods. *Preq:* C E 311 and 321, or consent of instructor.
- C E 815 Transportation Safety Engineering 3(3,0)** Methodology for conducting transportation accident studies; accident characteristics as related to operator, facility, and mode; statistical applications to accident data; current trends and problems in transportation safety. *Preq:* C E 311 or consent of instructor.
- C E 821 Advanced Soil Mechanics 3(3,0)** Stresses in soils; plastic equilibrium of soil masses; failure conditions; earth pressures; analysis of flexible retaining wall bulkheads; solution of problem by elastic theory. *Preq:* C E 321 or consent of instructor.
- C E 822 Foundation Engineering 3(3,0)** Requirements for satisfactory foundations; theory and design of shallow foundations; pressure distribution beneath rigid and flexible shallow foundations; bearing capacity and settlement of deep foundations; foundation failures. *Preq:* C E 821 or consent of instructor.
- C E 823 Asphalt Concrete Properties 3(3,0)** Identification and suitability of aggregates for construction; characteristics and properties of bituminous materials; materials behavior, construction, and design problems; use of microcomputers and the mainframe. *Preq:* C E 351 or consent of instructor.
- C E 825 Soil Dynamics and Geotechnical Earthquake Engineering 3(3,0)** Fundamentals of soil dynamics, plate tectonics, and earthquakes; application of the concepts to seismic ground response, design ground motions, soil liquefaction, seismic slope stability, dynamic lateral earth pressures, and soil improvement. *Preq:* C E 421, 424, or consent of instructor.
- C E 826 Properties of Portland Cement Concrete 3(3,0)** Material science and engineering of Portland cement concrete. Topics include physical and chemical properties of cements; mixture proportioning; mixing; placement; curing techniques; specifications, tests, and evaluation of fresh and hardened concrete; durability issues; and considerations in specialized applications. *Preq:* C E 351 or consent of instructor.
- C E 835 Construction Project Modeling 3(3,0)** Mathematical and computer models to simulate construction operations; linear models and optimization applications to construction materials, scheduling, and equipment allocation; typical computer models used in construction; simple modeling examples. *Preq:* C E 331 or consent of instructor.
- C E 836 Civil Engineering Quality Management 3(3,0)** Principles of total quality management (TQM) and their applications in the engineering and construction industry; TQM implementation techniques emphasizing the construction environment; concepts of quality assurance (QA) and quality control (QC) in construction.
- C E 837 Construction Specifications and Contracts 3(3,0)** Elements of specifications delineating responsibilities of all involved parties and identifying courses of action during abnormal circumstances; necessary parts of a contract dealing with governmental regulations and institutional preferences, licenses, bonds, insurance, and taxes. *Preq:* C E 331 or consent of instructor.
- C E 838 Materials Management 3(3,0)** Functions of construction materials management including design interface, purchasing, expediting, transportation, field control, and warehousing; design and application of integrated materials management computer systems; new technology that impacts materials management including bar coding, electronic data interchange, and voice recognition. *Preq:* Consent of instructor.
- C E 839 Expert Systems Applications in Civil Engineering 3(3,0)** Applications of expert systems in civil engineering design, construction, and facility management; use of expert systems shells for expert systems development; linking expert systems to external programs; knowledge acquisition and system validation.
- C E 840 Project Management Applications 3(3,0)** Quantitative tools for effective management and control of engineered projects from design through construction; cost coding and control, advanced schedule management techniques and quality management principles; extensive hands-on use of the microcomputer. *Preq:* C E 433 and 434, or consent of instructor.
- C E 846 Flow in Open Channels 3(3,0)** Free surface flow problems; applications of digital computer; concepts of boundary layer theory; uniform and varied flow; hydraulic jump; design criteria for prismatic channels and transitions; applications of unsteady flow. *Preq:* C E 342 or consent of instructor.
- C E 851 Reliability 3(3,0)** Elements of probabilistic methods; classical theory of structural reliability and reliability-based design methods. Term project required on reliability design in a relevant field of civil engineering.
- C E 853 Applications in Traffic Engineering 3(2,3)** Highway capacity analysis; design of unsignalized intersections; intelligent transportation systems; parking; traffic signal coordination; microscopic and macroscopic traffic simulation. *Preq:* C E 410 or consent of instructor.
- C E 854 Travel Demand Forecasting 3(2,3)** In-depth coverage of travel-demand forecasting theory and the four-step process; site impact analysis; disaggregate demand models. Students work in groups to develop a computer-based travel forecasting model for a small city. *Preq:* C E 412 or consent of instructor.
- C E 855 Transportation Seminar 1(1,0)** Practical discussion of the transportation profession featuring faculty and off-campus experts. Course is highlighted by a retreat where students present their transportation research.
- C E 860 Advanced Fluid Mechanics 3(3,0)** Laminar and turbulent flows; boundary layer and free shear flows (jets, wakes, etc.); descriptions of velocity, shear stress and pressure measurements, and aerodynamic drag.
- C E 861 Mechanics of Sediment Transport 3(3,0)** Characterization of sediments; physical principles governing fluvial, estuarial, and coastal transport of cohesionless and cohesive sediments, including incipient motion, stable channel design, bedforms, and bedload and suspended transport. *Preq:* C E 342 or consent of instructor.



**C E 865 Hydrologic Systems Analysis 3(3,0)** Hydrologic cycle as a hydrologic system; deterministic hydrology; aspects of physical hydrology emphasizing balanced approach to groundwater hydrology and surface water hydrology; infiltration; soil moisture and evapotranspiration; probability analysis and system synthesis by convolution. *Preq:* C E 342 or consent of instructor.

**C E 867 Pipeline Hydraulics 3(3,0)** Pressurized pipeline design including economic analysis, pipe sizing and selection; applications in civil engineering; prediction and control of cavitation; transient analysis; and methods of suppression. Students participate in a team-oriented design project. *Preq:* C E 341 or consent of instructor.

**C E 868 Environmental Fluid Mechanics and Hydraulics 3(3,0)** Study of turbulence and basic flow equations as they impact the environment. Includes slender flows including circular and plane turbulent jets, jets in crossflows, wall, surface jets, and plumes; near-field and far-field analysis of discharge in rivers including continuous momentum discharges, non-bouyant plumes, and passive slugs; mixing in lakes and reservoirs; and stratified flows.

**C E 875 Numerical Models in Hydraulics 3(3,0)** Students learn applications of numerical modeling, finite difference, finite volume, and finite element, as tools for solving complex problems in the areas of hydraulics/fluid mechanics. Students learn techniques of developing and analyzing computational models for parabolic, elliptic, and hyperbolic equations used in the area of hydraulics. *Preq:* C E 342 or consent of instructor.

**C E 889 Special Problems I 1-3** Research design problems from field of structures, construction, soil mechanics, transportation, ocean and coastal engineering, or materials engineering. Subject matter varies with interest and experience of student and instructor.

**C E 890 Special Problems II 1-3** Research design problems from field of structures, construction, soil mechanics, transportation, ocean and coastal engineering, or materials engineering. Subject matter varies with interest and experience of student and instructor.

**C E 891 Master's Thesis Research 1-12**

**C E 893 Selected Topics in Civil Engineering 1-6(1-6,1-6)** Topics not covered in other courses. May be repeated for credit.

**C E 895 Civil Engineering Seminar 1(0,2)** Current and historic topics in various areas of civil engineering. Speakers may include off-campus experts, faculty, and graduate students. Presentation of at least one seminar is required.

**C E 991 Doctoral Dissertation Research 1-12**

## COMMUNICATION STUDIES

**COMM (ENGL) 651 Film Theory and Criticism 3(2,3)** See ENGL 651.

**COMM 656 Crisis Communication 3(3,0)** In-depth examination of the use of communication in planning, managing, and responding to organizational crisis. *Preq:* Senior standing or consent of instructor.

**COMM 664 Advanced Organizational Communication 3(3,0)** Application of speech communication methodology to the analysis of organizational communication processes. Students study methods of organizational communication analysis and intervention. *Preq:* COMM 364 or consent of instructor.

**COMM 670 Communication and Health 3(3,0)** Considers institutional and health-care communication issues as well as the relationship between social issues, communication, and health. *Preq:* COMM 201 with a C or better or consent of instructor.

**COMM (ENGL) 691 Classical Rhetoric 3(3,0)** See ENGL 691.

**COMM (ENGL) 692 Modern Rhetoric 3(3,0)** See ENGL 692.

**COMM (ENGL) 804 Fundamentals of Health Communication 3(3,0)** See ENGL 804.

**COMM (ENGL) 807 Health Communication Campaign Planning and Evaluation 3(3,0)** See ENGL 807.

**COMM (A A H, ENGL) 840 Selected Topics 3(3,0)** See ENGL 840.

**COMM 861 Emergence of Professional Communication 3(3,0)** Details the historical beginnings of professional communication both in its rhetorical roots and its visual design history until 1940. As part of our histories, the theoretical schools up to contemporary theory are also covered.

**COMM 862 Contemporary Theories of Professional Communication 3(3,0)** Overview of major critical schools of thought since the 1940s examined across multiple contexts including written, digital, oral, and visual communications. Students undertake independent secondary research and write about theory in conjunction with academic and professional communication. *Preq:* ENGL 885 or equivalent theory course within discipline.

**COMM 871 Leadership Communication 3(3,0)** Develops ability and knowledge of communicative aspects of leadership. Students integrate theories and practices of persuasion, motivation, and media to actualize a leadership vision. Students explore issues and research in ethical and intercultural applications, including implications of institutional structures and their impact on society.

**COMM 873 Designing Workplace/Electronic Performance Support 3(3,0)** Analysis and design of application components and on-line design processes that solve organizational performance issues and contribute to workplace enhancement.

**COMM 874 Special Topics in Communication Studies 3(3,0)** Varying topics within the field of communication studies. May be repeated for a maximum of six credits, but only if different topics are covered.

## COMMUNITY AND RURAL DEVELOPMENT

**C R D (AP EC) 611 Regional Impact Analysis 3(3,0)** Techniques for analysis of the growth and decline of regions including economic-base theory, shift share, regional input-output, regional econometric models, and fiscal impact models. *Preq:* AP EC 202 or ECON 211 and 212.

**C R D (AP EC) 612 Regional Economic Development Theory and Policy 3(3,0)** Development of rural economic activity in the context of historical, theoretical, and policy aspects of friction associated with spatial separation. Location factors, transfer costs, location patterns, and regional-growth policy are considered. *Preq:* AP EC 202 or ECON 211 or equivalent.

**C R D 692 Case Study Project 3(3,0)** Capstone course engaging students in in-depth case study projects in community and economic development. Designed to enhance professional development, career interests, and practical experience. Students may participate in an internship, field experience, service learning activity, or investigation of a community, leadership, or economic development topic. *Preq:* C R D 336 and consent of instructor.

## COMPUTER ENGINEERING

See courses listed under Electrical and Computer Engineering.

## COMPUTER SCIENCE

**CP SC 605 Introduction to Graphical Systems Design 3(3,0)** Principles, computational techniques, and design concepts needed for designing systems for effective graphical displays. *Preq:* CP SC 212, 215, MTHSC 108, 311, with a C or better.

**CP SC 611 Virtual Reality Systems 3(3,0)** Design and implementation of software systems necessary to create virtual environments. Techniques for achieving real-time, dynamic display of photorealistic, synthetic images are discussed. Includes hands-on experience with electromagnetically-tracked, head-mounted displays and requires, as a final project, the design and construction of a virtual environment. *Preq:* CP SC 405 with a C or better.

**CP SC 612 Eye Tracking Methodology and Applications 3(3,0)** Introduction to the human visual system; visual perception; eye movements; eye tracking systems and applications in psychology, industrial engineering, marketing, and computer science; hands-on experience with real-time, corneal-reflection eye trackers, experimental issues. Final project requires execution and analysis of an eye tracking experiment. *Preq:* CP SC 360 or PSYCH 310 or MKT 431.

**CP SC 614 Human and Computer Interaction 3(3,0)** Survey of human and computer interaction, its literature, history, and techniques. Covers cognitive and social models and limitations, hardware, and software interface components, design methods, support for design, and evaluation methods. *Preq:* CP SC 212 and 215 with a C or better, or equivalent.

**CP SC 624 System Administration and Security 3(3,0)** Topics related to the administration and security of computer systems are covered. Primary emphasis is placed on the administration and security of contemporary operating systems. *Preq:* CP SC 360 and 332 or 422 with a C or better.



**CP SC 628 Design and Implementation of Programming Languages 3(3,0)** Overview of programming language structures and features and their implementation. Control and data structures found in various languages are studied. Runtime organization and environment and implementation models are also included. *Preq:* CP SC 231, 350, and 360 with a C or better.

**CP SC 629 Translation of Programming Languages 3(3,0)** Techniques and considerations for compiling and interpreting programming languages. Topics include scanning, parsing, optimization, code generation, and their theoretical foundations. Implementation of a compiler or a major component of a compiler normally is a term project. *Preq:* CP SC 350, 428.

**CP SC 655 Computational Science 3(3,0)** Introduction to the methods and problems of computational science. Course uses problems from engineering and science to develop mathematical and computational solutions. Case studies use techniques from Grand Challenge problems. Emphasizes the use of networking, group development, and modern programming environments. *Preq:* MTHSC 108, 311 and previous programming experience in a higher level language.

**CP SC 662 Database Management Systems 3(3,0)** Introduction to database/data communications concepts as related to the design of on-line information systems. Problems and solutions involving structuring, creating, maintaining, and accessing multiple-user databases are presented and solutions developed. Comparison of several commercially available teleprocessing monitor and database management systems is made. *Preq:* CP SC 360.

**CP SC 663 Online Systems 3(3,0)** In-depth study of the design and implementation of transaction processing systems and an introduction to basic communications concepts. A survey of commercially available software and a project using one of the systems is included. *Preq:* CP SC 462.

**CP SC 664 Introduction to Computer Architecture 3(3,0)** Survey of von Neumann computer architecture at the instruction-set level. Fundamental design issues are emphasized and illustrated using historical and current mainframe, supermini and micro architecture. *Preq:* CP SC 330 or consent of instructor.

**CP SC 672 Software Development Methodology 3(3,0)** Advanced topics in software development methodology. Techniques such as chief programmer teams, structured design and structured walkthroughs are discussed and used in a major project. Emphasis is on the application of these techniques to large-scale software implementation projects. Additional topics such as mathematical foundations of structured programming and verification techniques are also included. *Preq:* CP SC 360 and 372.

**CP SC 681 Selected Topics 1-3(1-3,0)** Areas of computer science in which nonstandard problems arise. Innovative approaches to problem solutions which draw from a variety of support courses are developed and implemented. Emphasis is on independent study and projects. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**CP SC 740 Computer Science for High School Teachers I 3(2,2)** Modern problem-solving and programming methods for high school teachers; algorithm development, software life cycle concepts, system hardware and software components, and an introduction to programming in PASCAL. Restricted to graduate students and in-service teachers in secondary education. *Preq:* Introductory computer programming.

**CP SC 801 Intensive Introduction to Computer Science for MFAC 5(3,2)** Fundamental concepts of computing for computer science graduate students who have no undergraduate degree in computing. Topics include object-orientated design and programming, computer organization, software development systems, data structures, and graphical user interfaces. Heavy emphasis on laboratory and project work. *Preq:* Consent of instructor.

**CP SC 805 Advanced Modeling Techniques in Computer Graphics 3(3,0)** Advanced techniques used in the artificial rendering of natural scenes; current practice in computer graphics; full software implementation of each technique; extensive coding. Offered spring semester only. *Preq:* CP SC 405.

**CP SC 807 3D Production Pipeline 3(3,0)** Immerses students in the world of 3D computer graphics. Makes use of current industry-standard software. Topics include concept development, storyboarding, modeling, rigging, animation, texturing, lighting, rendering, particles, scripting, compositing, and editing. *Preq:* Digital Production Arts major or consent of instructor.

**CP SC 808 Computer Animation 3(3,0)** Scripting systems, motion control, articulated figures, forward and inverse kinematics, soft object deformation, inbetweening key deformations, morphing, animating analytical models. *Preq:* MTHSC 311 and CP SC 611 or consent of instructor.

**CP SC 810 Introduction to Artificial Intelligence 3(3,0)** Problem solving and game playing; knowledge representation; expert systems; natural language processing; perception and learning. Offered spring semester only. *Preq:* Consent of instructor.

**CP SC 815 Special Effects Production 3(3,0)** Video special effects, compositing problems, effects animation, matchmoving and 3-D geometry, color and texture reconstruction from 2-D images; extensive use of scripting languages and high-end software platforms. *Preq:* CP SC 605 or 611 and ART 821 or consent of instructor.

**CP SC 820 Parallel Architecture 3(3,0)** Parallel processing issues; vector and pipeline processors; arrays of processing elements; associative processors; data flow computers; networks of processors; survey of parallel programming languages; design and implementation of parallel algorithms; future trends. Offered spring semester only. *Preq:* CP SC 664.

**CP SC 822 Case Study in Operating Systems 3(2,2)** Case study of the design of an operating system. Class periods are devoted to reviewing source code and deducing the structure of the system. Lab exercises require students to make major changes to the system to enhance its performance on particular workloads. *Preq:* CP SC 422, consent of departmental graduate affairs chair.

**CP SC 823 Operating Systems Design 3(3,0)** Analytic, simulation, and conceptual models of operating systems and their application to the design and implementation of actual systems; kernel design and its implementation in UNIX-like systems; models of concurrent processes, processor scheduling, and memory management. Offered fall semester only. *Preq:* CP SC 423, MTHSC 401.

**CP SC 824 Advanced Operating Systems 3(3,0)** Recent trends in system design and implementation; operating system structures to support reliable secure systems; verification techniques; fault tolerant systems; operating system considerations for closely coupled multiprocessor systems; network operating systems. Offered spring semester only. *Preq:* CP SC 623 or consent of instructor.

**CP SC 827 Translation of Programming Languages 3(3,0)** Theoretical foundations and algorithms for compiling and interpreting programming languages. Topics include lexical analysis, syntactic analysis, semantics analysis, optimization, and code generation. Implementation of a compiler or a major component of a compiler is normally a term project. *Preq:* CP SC 350, 428.

**CP SC 828 Theory of Programming Languages 3(3,0)** Syntax and semantics of programming languages; finite state and pushdown processors; context-free models of syntax; parsing algorithms and semantic models. *Preq:* CP SC 429, 450.

**CP SC 829 Advanced Compiler Topics 3(3,0)** Code generation, register allocation, program optimization, data flow, interprocedural operations, parallel compilation and distributed compilation. *Preq:* CP SC 429, 450.

**CP SC 830 Systems Modeling 3(3,0)** Fundamental concepts and techniques used in the stochastic modeling of computer and computer-based communication systems. Applications include hardware configuration design, software performance evaluation, and reliability estimation of fault-tolerant systems. Offered spring semester only. *Preq:* CP SC 630 and MTHSC 400 or 800 or consent of instructor.

**CP SC 838 Advanced Data Structures 3(3,0)** Search trees; data structures for sets; index structures for data bases; data abstraction and automated implementation; implicit data structures; storage compaction of lists; data structures for decision trees; data structures in areas such as computer graphics, artificial intelligence, picture processing, and simulation. Offered fall semester only. *Preq:* Consent of instructor.

**CP SC 839 Foundations of Theoretical Computer Science 3(3,0)** Preparation for the study of advanced issues in computational complexity, algorithm correctness, and inherent limits to computing; set theory and proof techniques; classes of the Chomsky hierarchy. *Preq:* CP SC 350 or consent of department chair.

**CP SC 840 Design and Analysis of Algorithms 3(3,0)** Basic techniques for design and analysis of algorithms; models and techniques for obtaining upper and lower time and space bounds; time/space trade-offs; inherently difficult problems. Offered spring semester only. *Preq:* MTHSC 419 or CP SC 650 or equivalent.



**CP SC 851 Software Systems for Data Communications 3(3,0)** Structure of software systems supporting communications among computing devices having diverse processing and communication capabilities; characterization of data communications software in terms of unified network architectures consisting of several functional layers; evaluation of several network architectures. Offered fall semester only. *Preq:* Consent of instructor.

**CP SC 852 Internetworking 3(3,0)** Network architecture and communication protocols underlying the global interoperability of the Internet. Topics include addressing and routing, interconnection of autonomous networks, naming and name resolution, connection management, flow and congestion control, and network management. *Preq:* CP SC 851, E C E 638, or consent of instructor.

**CP SC (ART) 860 Studio Computer Research 3-15(0,6-30)** See ART 860.

**CP SC 862 Database Management System Design 3(3,0)** Concepts and structures for design and implementation of a DBMS; theoretical foundations for query systems; data modeling and information representation; user interface and internal system design considerations; system performance modeling and measurement; topics from the literature. *Preq:* CP SC 462.

**CP SC 863 Multimedia Systems and Applications 3(3,0)** Principles of multimedia systems and applications; techniques in effectively representing, processing, and retrieving multimedia data such as sound and music, graphics, image, and video; operating system and network issues in supporting multimedia; advanced topics in current multimedia research. Term project requires implementing some selected components of a multimedia system. *Preq:* Consent of instructor.

**CP SC 864 Computer Architecture 3(3,0)** Computer architecture and structures from the classical Von Neumann machines to state-of-the-art computer organizations; nonconventional architectures such as array, pipeline, associative, data flow, reduction, and tree machines. Offered fall semester only. *Preq:* CP SC 664.

**CP SC 870 Software Design 3(3,0)** Fundamental concepts of object modeling using object-oriented analysis and design; realistic application of software engineering principles within a variety of problem domains; mainstream language with facilities for object-training programming. *Preq:* Proficiency in programming in a procedural language.

**CP SC 871 Foundations of Software Engineering 3(3,0)** Techniques and issues in software design and development; tools, methodologies, and environments for effective design, development, and testing of software; organizing and managing the development of software projects. *Preq:* Graduate standing in Computer Science.

**CP SC 872 Software Specification and Design Techniques 3(3,0)** Techniques, tools, environments, and formal methods for software specification and design; verification of design correctness. Offered fall semester only. *Preq:* CP SC 672 or equivalent.

**CP SC 873 Software Verification, Validation, and Measurement 3(3,0)** Proofs of correctness; test planning; static and dynamic testing; symbolic execution; automated testing; verification and validation over the software life cycle; software metrics; software maintenance. Offered spring semester only. *Preq:* CP SC 672 or equivalent.

**CP SC 875 Software Architecture 3(3,0)** Creation, analysis, and maintenance of architectures for software systems. Basic principles, patterns, and techniques. Quality attributes of the architecture are used to make a quantitative analysis. Students create and analyze two architectures from different domains.

**CP SC 881 Selected Topics 1-3(1-3,0)** Advanced topics from current problems of interest in computer science. Topics vary from semester to semester. May be repeated for credit, but only if different topics are covered. *Preq:* Consent of instructor.

**CP SC 888 Directed Projects in Computer Science 1-6** Directed individual project supervised by department faculty. To be taken Pass/Fail only.

**CP SC 891 Master's Thesis Research 1-12**

**CP SC 951 Seminar in Algorithms 1-3(1-3,0)** Advanced topics from current problems of interest in algorithms. May be repeated for credit.

**CP SC 952 Seminar in Computer Architecture 1-3(1-3,0)** Advanced topics from current problems of interest in computer architecture. May be repeated for credit.

**CP SC 953 Seminar in Database Systems 1-3(1-3,0)** Advanced topics from current problems of interest in database systems. May be repeated for credit.

**CP SC 954 Seminar in Operating Systems 1-3(1-3,0)** Advanced topics from current problems of interest in operating systems. May be repeated for credit.

**CP SC 955 Seminar in Programming Languages 1-3(1-3,0)** Advanced topics from current problems of interest in programming languages. May be repeated for credit.

**CP SC 956 Seminar in Programming Paradigms 1-3(1-3,0)** Advanced topics from current problems of interest in programming paradigms. May be repeated for credit.

**CP SC 957 Seminar in Software Engineering 1-3(1-3,0)** Advanced topics from current problems of interest in software engineering. May be repeated for credit.

**CP SC 981 Seminar in Computer Science 1-3(1-3,0)** Topics of current research interest. May be repeated for credit.

**CP SC 991 Doctoral Dissertation Research 1-12**

## CONSTRUCTION SCIENCE AND MANAGEMENT

**C S M 655 Reducing Adversarial Relations in Construction 3(3,0)** Focuses on the delivery of projects and how adversarial relations can affect the successful completion of the venture. Topics include management of human resources, understanding needs and processes of the participants, where problems lie, methods of avoiding and settling disputes. *Preq:* Construction Science and Management or Architecture major, senior standing, or consent of department chair.

**C S M 852 Construction Management Research 3(3,0)** Research methodology applied to the construction industry. *Preq:* Consent of instructor.

**C S M 860 Construction Financial Planning and Analysis 3(3,0)** Theory of financial management as it relates to the financial challenges faced by the construction firm.

**C S M 861 Construction Control Systems 3(3,0)** Development and analysis of cost, resource, and quality control programs for a company's construction projects.

**C S M 862 Personnel Management and Negotiations 3(3,0)** The role of management and unions in the construction industry. Topics include contract negotiation, collective bargaining, dispute resolution, and management for productivity improvement. *Preq:* Consent of instructor.

**C S M 863 Advanced Planning and Scheduling 3(3,0)** Analysis and control of construction projects using advanced techniques for planning, scheduling, and resources control. *Preq:* Consent of instructor.

**C S M 864 Construction Business Strategy and Marketing 3(3,0)** Techniques for business strategy development and marketing of various types of construction companies.

**C S M 865 Project Management 3(3,0)** Theory of project administration and control with special emphasis on the role and responsibilities of the project manager.

**C S M 866 Contractor Role in Development 3(3,0)** Addresses the various roles and responsibilities of the contractor in development including discussion of the owner/designer/constructor relationship. Does not count toward Master's in Construction Science and Management degree requirements. *Preq:* Consent of instructor.

**C S M 881 Professional Seminar 3(3,0)** New and emerging methods for management of the construction or construction-related firm. *Preq:* Consent of instructor.

**C S M 890 Directed Studies 3-6** Special topics not covered in other courses. Emphasis is on field studies, research activities, and current developments in building science. *Preq:* Consent of instructor.

**C S M 891 Master's Thesis Research 1-9** With approval of the advisory committee, students carry out independent research and analysis. Thesis is presented orally and in writing and in strict compliance with the guidelines of the Graduate School.



## CROP AND SOIL ENVIRONMENTAL SCIENCES

**CSENV 603 Soil Genesis and Classification 2(1,3)** Soil morphology and characterization, pedogenic processes, soil-forming factors, and classification of soils. Offered fall semester only. *Preq:* CSENV 202 or consent of instructor.

**CSENV 604 Soils and Land Use 2(1,3)** Soils interpretations for nonagricultural purposes and facilities. Emphasizes use of modern soil surveys; properties and features of soils important in nonfarm land uses. Not open to Crop and Soil Environmental Sciences minors or to students who have taken CSENV 202. Offered fall semester only.

**CSENV 605 Plant Breeding 3(2,2)** Application of genetic principles to the development of improved crop plants. Principle topics include the genetic and cytogenetic basis of plant breeding, mode of reproduction, techniques in selfing and crossing, methods of breeding, inheritance in the major crops, and biometrical methods. Offered spring semester only. *Preq:* GEN 302 or equivalent.

**CSENV 607 Introductory Weed Science 3(2,2)** Weed management in crops and pastures of the Southeast. Topics include weed identification, herbicide families and modes of action, herbicide formulations, herbicide diagnosis on crops and weeds, sprayer calibration and spray application, and nonchemical weed control strategies. *Preq:* AGRIC 104 or consent of instructor.

**CSENV (B E) 608 Land Treatment of Wastewater and Sludges 3(3,0)** Principles for designing environmentally acceptable land application systems using municipal and industrial wastewater and sludges are presented. Topics include land-limiting constituent analysis; soil-plant interactions; system equipment and design; system operation and management; public acceptance, social, and regulatory issues. Case studies and field trip(s) are planned. *Preq:* Senior standing in agriculture or engineering or consent of instructor.

**CSENV 617 Weed Morphology and Ecology 3(2,2)** Study of the morphological characteristics of weed plants of economic importance in row crops, pastures, and turf of South Carolina. Succession, reproduction, dissemination, distribution, competition, and allelopathy are discussed. *Preq:* CSENV 407 or 433 or consent of instructor.

**CSENV 621 Principles of Field Crop Production 3(3,0)** Principles for production of field crops. Topics include botany and physiology, tillage, harvesting, storage, and crop quality. Principles are illustrated using examples from various crops. Offered fall semester only. *Preq:* AGRIC 104 or equivalent introductory plant science, CSENV 202.

**CSENV 622 Major World Crops 3(3,0)** Examines the distribution, adaptation, production, and utilization of major agronomic crops of the world. Emphasizes crops important to U.S. agriculture. Specific crops discussed in more detail include corn, wheat, rice, sorghum, soybean, cotton, tobacco, and peanuts. Offered spring semester only. *Preq:* AGRIC 104 or equivalent introductory plant science, CSENV 202.

**CSENV 623 Field Crops—Forages 3(3,0)** Establishment, management, and utilization of forage crops in a forage-livestock agro-ecosystem context. Hay, silage, and pasture utilization are discussed. Computer model used to study complexity of forage-livestock production systems. *Preq:* AGRIC 104, CSENV 202, or consent of instructor.

**CSENV 624 Applied Aspects of Forage Management 1(0,2)** Hands-on exposure to forage plantings, establishment, and management practices. Pasture and harvested forage systems, equipment and practices; analysis of forage-livestock systems. *Preq:* CSENV 423 (or concurrent enrollment).

**CSENV 625 Seed Science and Technology 3(2,2)** Topics include seed development, germination, dormancy, pathology, storage, and deterioration. Seed testing and commercial production of seed are also covered. Emphasis is on useful applications of current seed science knowledge. Offered spring semester of even-numbered years only. *Preq:* AGRIC 104, BIOSC 205.

**CSENV (AP EC) 626 Cropping Systems Analysis 3(2,2)** Application of agronomic and economic principles in solving problems relating to the production and marketing of agronomic crops. Major part of the course is a case study in which detailed analysis of a farm, agribusiness, or environmental situation is made with students making formal written and oral presentations of results. Offered fall semester only. *Preq:* AGRIC 104, APEC 202, Junior standing.

**CSENV (HORT) 633 Integrated Weed Management for Agronomic and Horticultural Crops 3(2,2)** See HORT 633.

**CSENV 646 Soil Management 3(3,0)** Basic soil properties are related to compaction, water and solute movement, and root growth. Practical management problems are considered and solutions developed based on basic soil characteristics. Problems include erosion, no-tillage, compaction, irrigation, leaching, waste application, golf-green management, and orchard establishment. Offered fall semester only. *Preq:* CSENV 202.

**CSENV 652 Soil Fertility and Management 3(3,0)** Soil properties, climatic factors, and management systems in relation to soil fertility maintenance for crop production; plant nutrition and growth in relation to crop fertilization and management. Offered spring semester only. *Preq:* CSENV 202 or consent of instructor.

**CSENV 653 Soil Fertility Laboratory 1(0,3)** Evaluation and interpretation of soil fertility production. Offered spring semester only. *Preq:* CSENV 202 or consent of instructor.

**CSENV 675 Soil Physics and Chemistry 3(2,3)** Study of the principles of soil physics and chemistry and their applications. Topics include soil texture, structure, compaction, water relations, solute movement, mineral composition, adsorption phenomenon, and soil acidity. Offered fall semester only. *Preq:* CH 101, CSENV 202, PHYS 207.

**CSENV 690 Beneficial Soil Organisms in Plant Growth 3(3,0)** Aspects of biological nitrogen fixation, mycorrhizal fungi, microbial-pesticide interactions, bioremediation, nutrient cycles, and biological pest control related to plant growth soil/environmental quality, and sustainable agriculture. Students who desire laboratory experience in these topics may register for CSENV 406 after consultation with instructor. Offered spring semester only. *Preq:* CSENV 202, MICRO 305, PL PA 401, or consent of instructor.

**CSENV 701 Soils and Man 3(3,0)** Different kinds of soils, their properties, uses, management, conservation, and relationship with the environment and other human endeavors.

**CSENV 801 Crop Physiology and Nutrition 3(3,0)** Basic concepts and physiologic aspects of growth and culture applied to crop management practices. Offered fall semester of odd-numbered years only. *Preq:* BIOSC 401, 402; or equivalent.

**CSENV 802 Pedology 3(3,0)** Current concepts and theories in soil genesis and morphology; advanced study of soil taxonomy. Offered fall semester of odd-numbered years only. *Preq:* CSENV 403.

**CSENV 804 Theory and Methods of Plant Breeding 3(3,0)** Concepts and principles of plant breeding and genetics as applied to development and maintenance of improved crop varieties; theoretical considerations of various breeding methods. Offered fall semester of even-numbered years only. *Preq:* CSENV 405, EX ST 801, or consent of instructor.

**CSENV 805 Soil Fertility 3(3,0)** Soil properties affecting nutrient availability and plant growth; inventory of major soil groups with reference to plant stress features; behavior of essential elements in soils in relation to plant availability; current soil fertility research. Offered spring semester of even-numbered years only. *Preq:* CSENV 403 or 452 or consent of instructor.

**CSENV 806 Special Problems 1-3(0,3-9)** Research not related to a thesis.

**CSENV 807 Soil Physics 4(3,3)** Principles and applications of transport of water and solutes in soils emphasizing unsaturated flow phenomenon. Offered fall semester of even-numbered years only. *Preq:* MTHSC 108 or equivalent.

**CSENV 808 Soil Chemistry 3(2,3)** Principles and theories concerning the structure and chemical properties of soil colloids, ion exchange and surface phenomena, chemical equilibria, soil acidity, and oxidation-reduction reactions. Offered fall semester of odd-numbered years only.

**CSENV 810 Soil Microbiology 3(3,0)** Biological nitrogen fixation, mycorrhizal fungi, and pesticide interactions in soils with emphasis on microbial-plant-soil relationships. Offered fall semester of even-numbered years only. *Preq:* CSENV 690 or MICRO 610 and consent of instructor.

**CSENV 812 Crop Ecology and Land Use 3(3,0)** Concepts and factors affecting adaptation and distribution of crop plants; microclimate and crop response to environmental factors with modifications of microclimate by agricultural operations; interactions among crop plants and between weeds and crop plants under field conditions. Offered fall semester of even-numbered years only.



**CSENV (PES) 850 Agricultural Biotechnology 2(2,0)** Fundamentals of biotechnology for students specializing in applied life sciences. Scientific principles, limitations, novel concepts, and wide-ranging applications of biotechnology to agricultural industry.

**CSENV 890 Special Topics in Agronomy 1-3(1-3,0)** Group discussion of recent developments in agronomic research. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.

## EARLY CHILDHOOD EDUCATION

**ED EC 800 Parent Education in Early Childhood Multicultural Settings 3(3,0)** Focuses on a multicultural perspective on parent education and involvement in early childhood settings (birth to age eight). Theory and comparative applications of parent involvement in multicultural classroom and home environments are studied.

**ED EC 840 Theories of Early Childhood Education 3(3,0)** Examines the theoretical, philosophical, and research foundations of early childhood education. Students develop skills in critical inquiry as they explore specific topics related to early child care and education.

**ED EC 880 Current Issues in Early Childhood 3(3,0)** Focuses on factors that impact early childhood policy, identification of current problems/issues, and development of research-based advocacy strategies.

## ECONOMICS

**ECON 605 Introduction to Econometrics 4(3,3)** Introduction to the methods of quantitative analysis of economic data. Reviews basic statistical methods and probability distribution. Topics include data management using professional statistical software applications; multiple regression analysis; hypothesis testing under conditions of multicollinearity, heteroscedasticity, and serial correlation. *Preq:* ECON 211 and 212; MTHSC 108 or 207; EX ST 301 or MTHSC 301 or 309.

**ECON 606 Advanced Econometrics 3(3,0)** Reviews statistical inference using multiple regression (OLS) analysis and model specification. Topics include multicollinearity; heteroscedasticity and serial correlation; two-stage least squares and instrumental variables models; simultaneous equations models; limited dependent variable models using maximum likelihood estimation and time-series analysis; and presentation of results in technical writing. *Preq:* ECON 405 or consent of instructor.

**ECON 610 Economic Development 3(3,0)** Consideration and analysis of economic and related problems of underdeveloped countries. Attention is given to national and international programs designed to accelerate solution of these problems. *Preq:* ECON 314 or consent of instructor.

**ECON 611 Economics of Education 3(3,0)** Analysis of economic issues related to education. The decision to invest in education, elementary and secondary school markets and reform, the market for college education, teacher labor markets, and education's effects on economic growth and income distribution. *Preq:* ECON 314 or consent of instructor.

**ECON 625 Antitrust Economics 3(3,0)** Analysis of economic and legal issues created by the exercise of market power. The motivation and execution of government policy toward mergers, predatory conduct, and various restraints of trade are extensively examined. *Preq:* ECON 309 or 314 or consent of instructor.

**ECON 626 Seminar in Sports Economics 3(3,0)** Economic analysis of sports teams, leagues, and institutions. Topics include antitrust issues, public funding of sports venues, labor relations, wagering markets, athlete compensation, and application of economic principles to sports settings. Empirical research project is cornerstone of course. *Preq:* ECON 314 and 405 or consent of instructor.

**ECON 640 Game Theory 3(3,0)** Introduction to the formal analysis of strategic interaction among rational, self-interested rivals. Basic theoretical aspects of games are discussed and applied to such topics as bargaining, voting, auctions, and oligopoly. *Preq:* ECON 314 and MTHSC 106, or ECON 430, or consent of instructor.

**ECON 751 Selected Topics for Teachers 3(3,0)** Current economic policy issues such as inflation, regulation, protectionism, and energy policy. Emphasis is on the presentation of these topics to secondary school students. Topics vary from year to year. May be repeated for credit. *Preq:* ECON 200, 211.

**ECON (AP EC) 800 History of Economic Thought 3(3,0)** Development of economic thought from early Greek to Keynesian economics; writings of major economists such as Smith, Ricardo, Marx, Marshall, and Keynes; development of major economic theories.

**ECON (AP EC) 801 Microeconomic Theory 3(3,0)** Microeconomic theory and its use to analyze and predict the behavior of industries, firms, and consumers under various market conditions. Offered fall semester only.

**ECON (AP EC) 802 Advanced Economic Concepts and Applications 3(3,0)** Rigorous development of price theory under alternative product and resource market structures. *Preq:* Consent of instructor.

**ECON (AP EC) 804 Applied Mathematical Economics 3(3,0)** See AP EC 804.

**ECON 805 Macroeconomic Theory 3(3,0)** Macroeconomic theory involving static and dynamic models and their use in analysis of economic problems and policies.

**ECON (AP EC) 806 Econometrics I 3(3,0)** See AP EC 806.

**ECON (AP EC) 807 Econometrics II 3(3,0)** Economic models expressed as systems of equations; problems of identification, parameter estimation, measurement errors, and statistical inference; techniques of simulation, forecasting, model validation, and interpretation. Offered fall semester only.

**ECON (AP EC) 808 Econometrics III 3(3,0)** Continuation of ECON (AP EC) 807; current economic models and estimation procedures. Offered spring semester only. *Preq:* ECON (AP EC) 807.

**ECON (AP EC) 809 Advanced Natural Resource Economics 3(3,0)** See AP EC 809.

**ECON (AP EC) 810 Natural Resources Management and Policy 3(3,0)** See AP EC 810.

**ECON (AP EC) 811 Economics of Environmental Quality 3(3,0)** Pricing and distribution emphasizing effects upon economic welfare; goods allocated by government purchase for joint consumption and those distributed by rationing; alternate plans for allocating public goods. Offered fall semester of even-numbered years only. *Preq:* ECON 314 or equivalent.

**ECON (AP EC) 816 Labor Economics 3(3,0)** Wage and employment theory; labor markets; labor history; current problems in labor and manpower economics.

**ECON (AP EC) 817 Advanced Production Economics 3(3,0)** See AP EC 817.

**ECON (AP EC) 820 Public Finance 3(3,0)** Impact of government on resource allocation, income distribution and stability; role of regulation; principles of taxation.

**ECON 821 Public Choice 3(3,0)** Economic theory to analyze collective decisions. Topics include the pure theory of collective choice and applied analyses of democratic governments and their policy processes.

**ECON (AP EC) 822 Contemporary Public Policy 3(3,0)** See AP EC 822.

**ECON 823 Microeconomics for Public Policy 3(3,0)** Economic aspects of public policy making; individual behavior as governed by the market and other incentive mechanisms. Equips students with methodological tools for evaluating public policies. *Preq:* Admission to the Policy Studies program or consent of instructor.

**ECON (AP EC) 824 Organization of Industry 3(3,0)** The structure of markets and firms; forces that determine the size of firms and the boundaries of markets; the behavior of firms, both singly and in concert, to exploit market positions.

**ECON 825 Antitrust Economics 3(3,0)** Theoretical analysis of monopoly, monopolizing practices, and the exercise of market power. Study of government policy towards mergers, predation, and restraints of trade. *Preq:* ECON (AP EC) 801.

**ECON (AP EC) 826 Economic Theory of Government Regulation 3(3,0)** The scope of governmental regulation in the economy of the United States, its evolution and development; the application of the tools of economic analysis to the issues of regulated enterprise. *Preq:* ECON 314 or equivalent.

**ECON (AP EC) 827 Economics of Property Rights 3(3,0)** Analyzes the evolution and impact of various property rights institutions on individual behavior and the subsequent use of resources. Particular attention is paid to the importance of property rights structures in the organization of business and in managerial decision making. *Preq:* ECON 801.

**ECON (AP EC) 828 Market Structure in Agricultural Industries 3(3,0)** See AP EC 828.

**ECON (AP EC) 831 Economic Development 3(3,0)** Economic analysis of development of urban areas within the system of cities; central place theory and general equilibrium models of inter-regional economic activity emphasizing central place systems, spatial interaction and stochastic processes; internal development of the city focusing on housing and land use patterns, transportation, and urban form.



**ECON (AP EC) 832 Community and Regional Economics 3(3,0)** See AP EC 832.

**ECON 836 Research in Economics of Education 3(3,0)** Theoretical and econometric analysis of education including such topics as human capital theory, pricing and competition in higher education, public financing and provision of education, cost/benefit analyses of education reforms such as accountability, school finance equalization, and school choice. Includes discussion and research on current topics in the economics of education. *Preq:* AP EC (ECON) 806 or consent of instructor.

**ECON (AP EC) 840 International Trade Theory 3(3,0)** Theory of free trade from Ricardo to the present; theory and application of optimal and second-best tariffs; recent empirical testing of trade and tariff theory. *Preq:* ECON 314 and (AP EC) 802 or consent of instructor.

**ECON (AP EC) 841 International Finance 3(3,0)** Financial economics of decision making in a multinational environment featuring autonomous governments and multiple currencies. Typical topics include the macroeconomic problems of unemployment and inflation in an international economy, management of exchange rate risk, credit risk, political risk, and taxation. *Preq:* ECON 315 or equivalent.

**ECON (AP EC) 855 Financial Economics 3(3,0)** Modern theory of corporate finance; basic theories of efficient markets, portfolio selection, capital asset pricing, option pricing, and agency costs. *Preq:* ECON (AP EC) 801 or consent of instructor.

**ECON (AP EC) 888 Directed Reading in Economics 1-3(1-3,0)** Directed reading and research in the student's field of interest. May be repeated for a maximum of three credit.

**ECON 891 Master's Thesis Research 1-12**

**ECON (AP EC) 899 Selected Topics 1-3(1-3,0)** See AP EC 899.

**ECON 900 Selected Topics in Economics 3(3,0)** Current topics in economic theory and empirical research. May be repeated for credit, but only if different topics are covered.

**ECON (AP EC) 901 Price Theory 3(3,0)** Neoclassical paradigm of market price and quantity; rigorous consideration of consumer behavior, the theory of the firm and market equilibrium, production and resource demands, and the supply of resources. *Preq:* ECON (AP EC) 801 or equivalent.

**ECON (AP EC) 903 General Equilibrium and Welfare Theory 3(3,0)** See AP EC 903.

**ECON (AP EC) 904 Seminar in Resource Economics 3(3,0)** See AP EC 904.

**ECON (AP EC) 905 Advanced Macroeconomic Issues 3(3,0)** Current unsettled issues in macroeconomic analysis. Topics include disequilibrium macro models, macro models of open economies, rational expectations and its critics, government stabilization policies and the controversy surrounding the concept of Ricardian equivalence. *Preq:* ECON 805 or equivalent.

**ECON (AP EC) 906 Seminar in Area Economic Development 3(3,0)** See AP EC 906.

**ECON 911 Problems in Price Theory 3(3,0)** Price theory problems and exercises in preparation for standing the comprehensive examination preliminary to admission to candidacy to the PhD degree in Applied Economics. May be repeated up to three times.

**ECON 915 Problems in Macroeconomic Theory 3(3,0)** Review of problems and exercises in macroeconomic theory to help integrate formal theory from advanced courses. *Preq:* ECON (AP EC) 905 or permission to stand PhD preliminary examination in the next semester.

**ECON (AP EC) 917 Advanced Seminar in Labor Economics 3(3,0)** Continuation of ECON 816, bridging the gap between theory and modern empirical research in labor economics. Emphasizes reading recent empirical research papers to understand the techniques of modern research in labor economics. *Preq:* ECON (AP EC) 816.

**ECON 920 Empirical Public Economics 3(3,0)** Studies the effects of taxation on household and firm behavior, public goods, income transfer, and welfare policies. Considers fiscal federalism, public policy, and economic growth. Includes selected topics on effects of legislation and institutions on economic outcome. *Preq:* ECON (AP EC) 801, (AP EC) 807, (AP EC) 820.

**ECON (AP EC) 950 Monetary Economics 3(3,0)** Economic analysis of money in our economy and effects of monetary policy on prices, interest rates, output, and employment.

**ECON 980 Workshop in Applied Economics 3(3,0)** Forum for presentation and critical evaluation of ongoing research by candidates for the PhD degree in Applied Economics. May be repeated for a maximum of nine credits. *Preq:* Consent of instructor.

**ECON (AP EC) 991 Doctoral Dissertation Research 1-12** See AP EC 991.

## EDUCATION

**ED 641 Middle School Curriculum 3(3,0)** Concepts and methods for teaching middle school students. Discusses nature of middle school students, teacher characteristics, curricular and co-curricular programs, organization, and teaching.

**ED (CTE) 700 Supervising the Student Teacher in the Public School 2-3(2-3,0)** Knowledge and skills desirable for supervisors of student teachers; use of observation instruments for recording objective data and evaluating teaching performance. To be taken Pass/Fail only. *Preq:* Professional teaching certificate, at least one year of teaching experience, recommendation from employing school district, or consent of instructor.

**ED 735 Teacher Professional Development: Selected Topics 1-3(1-3,0)** Selected topics determined by professional-development needs for teachers. Does not count toward a master's degree; for professional development credit only. May be repeated, but only if different topics are covered.

**ED 738 Selected Topics in Education 1-3(1-3,0)** Specific master's-level topics not found in other courses. May be repeated for a maximum of six credits, but only if different topics are covered.

**ED 739 Independent Study in Education 1-3(1-3,0)** Master's-level study of selected topics under direction of a faculty member chosen by the student; development of a course of study different from any existing courses and designed for the individual student. May be repeated for a maximum of six credits, but only if different topics are covered.

**ED 837 Teacher as Learner During the National Board Certification Process 3(2,3)** Connects knowledge of teaching and learning theories, strategies, and classroom practices to standards for National Board certification; supports teachers in applying content knowledge and collecting/analyzing evidence based on certification criteria.

**ED 838 Teacher as Reflective Practitioner and National Board Certification 3(2,3)** Supports analysis of classroom instruction and assessment through reflective teaching practices; based on National Board of Professional Teaching Standards; guidance in preparing portfolios and completing national assessments.

**ED 840 Program Development and Implementation in Early Childhood Education 3(2,2)** Examines current issues in early childhood curriculum, their sources, and the beliefs supporting them. In addition, each student designs a modified curriculum for a specific content area and level. *Preq:* Relevant teaching experience or consent of instructor.

**ED 860 Classroom Action Research 3(3,0)** Develops skills for doing research in a K-12 setting on instructional methodology and/or curriculum. Study of research literature, research methods, and IRB procedures. Includes classroom action research project. *Preq:* Teaching certification, admission to MEd degree program, ED F 778, 808, or consent of instructor.

**ED (AG ED, CTE) 889 Research in Education 3(3,0)** See AG ED 889.

**ED (ED F, ED SP) 894 Directed Research 1-4(1-4,0)** Research in a line of inquiry in education under the direction of faculty. Specific educational question is investigated and reported using appropriate methodology. To be taken Pass/Fail only. *Preq:* ED F 778, 808 or consent of instructor.

**ED 901 Selected Topics Doctoral Study 1-3(1-3,0)** Doctoral-level education topics not covered in other courses. May be repeated for a maximum of six credits, but only if different topics are covered.

**ED 902 Independent Doctoral Study 1-3(1-3,0)** Doctoral-level study of selected topics in education under the direction of a faculty member chosen by the student; development of a course of study different from any existing courses and designed for the individual student. May be repeated for a maximum of six credits, but only if different topics are covered.

**ED 954 Curriculum Theory 3(3,0)** Main currents of curriculum theory in American education. *Preq:* ED EL 760.

**ED 955 Theoretical Bases of Instruction 3(3,0)** Seminar in the application of learning theory to instructional practice emphasizing instructional strategies in the classroom.



**ED (ED F, ED SP) 980 Internship in Curriculum and Instruction 1-6(0,3-18)** Practical experiences linking the student's program of study to his/her field of professional service. To be taken Pass/Fail only. *Preq:* Consent of advisor.

**ED (ED F, ED SP) 991 Doctoral Dissertation Research 1-18**

## EDUCATIONAL COUNSELING (Counselor Education)

**ED C 764 Theoretical and Practical Application of Student Development and Leadership in a University Setting 3(3,0)** Development of leadership, programming, problem-solving, conflict-resolution, confrontation, and referral skills; legal and ethical issues and the implications for practitioners; comparative studies of housing programs and utilization of resources and support services available on the campus.

**ED C 801 Foundations of Professional School Counseling 3(3,0)** Theory and practice of school counseling; principles and policies underlying programs.

**ED C 803 Student Development Services in Higher Education 3(3,0)** Pupil personnel services offered by institutions of higher education.

**ED C 804 Theories of Student Development in Higher Education 3(3,0)** Developmental aspects of the young adult age group and the relationship to postsecondary schools and training programs.

**ED C 805 Community Counseling 3(3,0)** History and description of various counseling services provided in agency settings; the type of client populations served and existing legislative acts mandating these services.

**ED C 806 Student Affairs Issues 3(3,0)** Introduction to the current issues in the student personnel profession and future challenges facing student affairs departments. *Preq:* ED C 803, 804.

**ED C 807 Counseling Children and Adolescents 3(3,0)** Theory and techniques in the area of counseling youth in educational institutions and other settings; history and definition of disordered behavior, the etiology and occurrence of childhood disorders, developmental context, classification and assessment, and treatment issues. *Preq:* ED F 701, ED C 801, 810, or consent of instructor.

**ED C 808 Legal and Ethical Issues in Student Affairs Practice and Counselor Education 3(3,0)** Study of current legal and ethical issues confronting counselor educators and administrators working in student affairs practice and student affairs counseling. Examines a representative sample of key concepts, federal, and state court cases and explores the application of legal and ethical issues to student affairs practice and counseling.

**ED C 809 Program Administration and Leadership in Higher Education 3(3,0)** Process of organizing the personnel and financial resources needed to meet effectively student development and institutional goals and objectives. *Preq:* Consent of instructor.

**ED C 810 Theories and Techniques of Counseling 3(3,0)** Counseling theories and techniques. *Preq:* ED C 801 or consent of instructor.

**ED C 811 Multicultural Counseling 3(3,0)** Responsibility of counselors to all people regardless of race, sex, gender, socioeconomic status, subculture, etc.; content and theory related to counseling multicultural individuals/groups.

**ED C 812 Career Counseling 3(3,0)** Gathering, interpreting, and utilizing educational, social, and occupational information; techniques used in placement, survey, and follow-up.

**ED C 813 Appraisal Procedures 3(2,2)** Experience in gathering, interpreting, and utilizing data related to the individual; especially significant to counselors. *Preq:* ED F 808 or consent of instructor.

**ED C 814 Development of Counseling Skills 3(3,0)** On-campus experience to help counselors develop communication skills through role-playing activities, audio and videotaping, interviewing, lecture, and discussion. *Preq or Coreq:* ED C 810.

**ED C 815 Group Counseling 3(3,0)** Experience as a member of a group to aid the student in understanding group dynamics and the role of a group member as a participant and facilitator; emphasis is on small group participation, communication skills, and self-understanding. *Preq:* Consent of instructor.

**ED C 816 Introduction to Marriage and Family Counseling 3(3,0)** Major models and techniques of marriage and family counseling; history, research, legal, ethical, and other professional issues; concepts related to family life cycle, healthy family functioning, divorce, ethnicity, problem conceptualization, and nontraditional structures. *Preq:* ED C 810 or 814 or consent of instructor.

**ED C 818 Psychopathology for Counselors 3(3,0)** Conceptual models employed in classifying and describing various mental disturbances as well as approaches used to alleviate these disturbances. *Preq:* ED C 810, enrollment as Counseling master's student, consent of instructor.

**ED C 819 The American College Student 3(3,0)** How college students change and develop and how college can enhance that development.

**ED C 821 Counseling Psychodiagnosis 3(3,0)** Comprehensive overview of the DSM-IV-TR; multi-axial assessment and diagnosis of mental disorders including coding and reporting procedures. *Preq:* ED C 810, enrollment as Counseling master's student, consent of instructor.

**ED C 822 Addictions Counseling 3(3,0)** Comprehensive overview of the phenomenon of chemical dependence and addiction; current methods of identification and intervention; awareness of how addictions affect individuals, families, schools, and communities. *Preq:* Consent of instructor.

**ED C 823 Advanced Counseling Techniques and Strategies 3(3,0)** Development of in-depth counseling skills; techniques for working with a wide variety of populations and/or problems. *Preq:* ED C 814, 815, completion of 30 hours in a master's program in Counseling, or certification as a school counselor.

**ED C 830 Professional School Counseling Practicum 3(1,6)** Supervised field experience in counseling and other services in a school setting. *Preq:* ED C 801, 814, or consent of instructor.

**ED C 834 Student Affairs Practicum 3(1,6)** Supervised field experience in counseling and other student services in a postsecondary school setting. *Preq:* ED C 803, 804, or consent of instructor (100 clock hours).

**ED C 836 Community Practicum 3(1,6)** Supervised field experiences in counseling and other services in a community-agency setting. *Preq:* ED C 814 or consent of instructor.

**ED C 840 Independent Study in Counseling 1-3(1-3,0)** Individualized, in-depth study of a particular topic not offered in other courses. Reading, research, and independent study are supervised by a faculty member. *Preq:* Consent of instructor.

**ED C 841 School Counseling Internship 1-6** Students apply previous knowledge in consulting, counseling, and coordinating services in a supervised field experience for the school student. *Preq:* ED C 810, 830, or consent of instructor.

**ED C 844 Student Affairs Internship 1-6** Application of previous knowledge to professional and postsecondary settings in a supervised field experience in counseling/student services. *Preq:* ED C 834, consent of instructor.

**ED C 846 Community Counseling Internship 1-6** Students apply previous knowledge of counseling theory and techniques in a supervised field experience to professional mental health counseling settings. *Preq:* ED F 701, ED C 805, 813, 814, 815, 836, consent of instructor (600 clock hours).

**ED C 885 Selected Topics 1-3(1-3,0)** Developing trends in counseling not covered in other courses. May be repeated, but only if different topics are covered.

**ED C 915 Internship in Counseling Setting 3(1,6)** Postmaster's supervised internship in counseling. Provides experience in counseling as well as coordination of services for a diverse client population. Students participate in direct services with clients in an approved agency. May be repeated for a maximum of six credits. *Preq:* Master's degree in Counseling or related field approved by program coordinator.

**ED C 920 Counselor Supervision 3(3,0)** Overview of conceptual and empirical literature on counselor supervision that includes models, approaches, techniques, relationship/process issues, legal concerns, and ethical considerations. Students develop supervision skills through readings, seminar discussions, and supervision of master's-level students. *Preq:* Master's degree in Counseling or related area or consent of instructor.

## EDUCATIONAL FOUNDATIONS

**ED F (AG ED, THRD) 680 Educational Applications of Microcomputers 3(2,2)** Fundamentals of computer applications for teachers. Develops competence in general computer applications such as word processing and database management and addresses educational uses of the Internet and computer-assisted instruction, with emphasis on legal and ethical issues and the impact of computer technology upon society. *Preq:* Admission to graduate teacher education program.



**ED F (AG ED, THRD) 682 Advanced Educational Applications of Microcomputers 3(2,2)** Provides students with the knowledge and skills needed to apply microcomputer technology to the utilization and generation of educational software in accordance with sound educational principles. *Preq:* ED F (AG ED, THRD) 480.

**ED F 690 Student Management and Discipline 3(3,0)** Aids pre-service and in-service teacher development and refines knowledge, skills, and values important for managing students in school settings. Practical application of theory and research and legal and ethical considerations are emphasized. *Preq:* ED F 302 or PSYCH 201; ED F 334 and 335 or suitable alternative; minimum grade-point ratio of 2.0.

**ED F 697 Instructional Media in the Classroom 3(3,0)** Integrated approach to the use of audio-visual media stressing systematic planning, selection, utilization, and evaluation as well as production of materials and equipment operation. *Preq:* Minimum grade-point ratio of 2.0.

**ED F 701 Human Growth and Development 3(3,0)** Theory and research in human development and its impact on the teaching/learning process. *Preq:* ED F 334, 335, 336, or equivalent; classroom teaching experience.

**ED F 702 Advanced Educational Psychology 3(3,0)** Educational applications of research and theory on objectives, motivation, class climate, class management, and learning theory. *Preq:* ED F 302 or equivalent; classroom teaching experience recommended.

**ED F 703 Early Adolescent Growth and Development 3(3,0)** Theory and research in early adolescent growth and development and the teaching/learning process for middle-grades youth. *Preq:* Graduate standing or consent of instructor.

**ED F 766 Integrating Service Learning into Curriculum 3(2,3)** Opportunities for certified teachers to build competence in service learning through personal participation in service and in reflection. Students develop a plan to integrate service learning activities into the curriculum of their school and/or district. Designed for 12–25 elementary, middle-school, high-school, and adult-education teachers. *Preq:* Teaching certification.

**ED F 778 Experimental and Nonexperimental Research Methods in Education I 3(3,0)** Types of educational research and uses; logical bases of quantitative and qualitative analysis techniques; basic research issues important in education; educational research design and procedures; introduction to measurement and evaluation; applications to special problems in classroom settings and program development; and evaluation in curriculum, administration, and educational support services. *Preq:* EX ST 301 or equivalent or consent of instructor; ED F 808 recommended.

**ED F (ED L) 800 Philosophy, Schooling, and Educational Policy 3(3,0)** See ED L 800.

**ED F 808 Educational Tests and Measurements 3(3,0)** Construction, use, and interpretation of subjective and standard tests; measurement applications.

**ED F 870 Schooling as a Cultural Process 3(3,0)** Critical analysis of the interdependence of schooling and culture.

**ED F 872 History of American Education 3(3,0)** Historical development of educational purpose and the social and cultural forces which shaped that development.

**ED F 875 Seminar in Human Growth and Development 3(3,0)** Selected topics in human development from any area of the lifespan. Development topics are examined for their impacts on the teaching/learning process, administrative processes, and/or counseling approaches. *Preq:* ED F 701 or equivalent and teaching, counseling, or administrative experience.

**ED F 878 Experimental and Nonexperimental Research Methods in Education II 3(3,0)** Advanced concepts and skills needed to analyze, conduct, and evaluate educational research; nonexperimental, quasi-experimental, and experimental design specific to problems in educational research; complementary educational research methods involving qualitative approaches; coding and computer analysis of sample data; summarization and interpretation of data; applications of measurement and evaluation in educational research. *Preq:* ED F 778, 808, EX ST 801, or equivalent.

**ED F 879 Qualitative Research in Education 3(3,0)** Application of qualitative studies to educational questions; nature of qualitative research; rationale and applications of qualitative research methods; integration of qualitative and quantitative research methods in educational research. *Preq:* ED F 778, 878, or equivalent.

**ED F 880 Instructional Technology in the Elementary and Middle School 3(2,2)** Research-based strategies for integrating instructional technology within the curriculum; methodologies for deploying technology in support of national standards through participation in and development of project-based learning activities. *Preq:* Consent of instructor.

**ED F (ED, ED SP) 894 Directed Research 1-4(1-4,0)** See ED 894.

**ED F 908 Advanced Educational Tests and Measurement 3(3,0)** Theoretical and quantitative aspects of modern and classical test theory from the practitioner's perspective; solving contemporary problems involving intra-student and class level comparisons of student progress; the subsequent impact of assessment on classroom high-stakes accountability decisions. *Preq:* ED F 808 or equivalent; ED F 778 or equivalent.

**ED F 980 (ED, ED SP) Internship in Curriculum and Instruction 1-6(0,3-18)** See ED 980.

**ED F (ED, ED SP) 991 Doctoral Dissertation Research 1-18** See ED 991.

## EDUCATIONAL LEADERSHIP

**ED L 700 Public School Administration 3(3,0)** Theoretical bases of school administration; organizational principles, patterns, and practices in public schools; decision making; administration of programs and services. *Preq:* Three graduate education courses or consent of instructor.

**ED L 705 The Principalship 3(3,0)** Roles and responsibilities of the principalship including the organization and administration of schools.

**ED L 710 Organizational Theory for School Administrators 3(3,0)** Theory of management, communication, human relations, social systems, motivation, contingency, decision making, and change. *Preq:* ED L 700.

**ED L 715 School and Community Relationships 3(3,0)** Interdependence of school and community; identifying and defining societal expectations of schools and effect of these expectations on educational policy; impact of social, political, economic, and demographic change on educational policy.

**ED L 720 School Personnel Administration 3(3,0)** School personnel selection, practices, and problems. *Preq:* ED L 700, 705.

**ED L 725 Legal Phases of School Administration 3(3,0)** Legal principles involved in school administration and in court actions. *Preq:* ED L 710.

**ED L 730 Techniques of Supervision—the Public Schools 3(3,0)** Improving, coordinating, and evaluating instruction; modern trends of supervisory practices. *Preq:* ED L 710.

**ED L 735 Educational Evaluation 3(3,0)** Evaluation theory and design applied to classroom instruction and to evaluation procedures applicable to school center and district programs and projects. *Preq:* ED L 710.

**ED L 740 Curriculum Planning and Improvement for School Administrators 3(3,0)** Role of leadership in curriculum planning and improvement: curriculum evaluation and development, change, programmatic requirements, cocurriculum, organization, scheduling, planning, management, and technology. *Preq:* ED L 710.

**ED L 745 School Finance 3(3,0)** School finance relative to programs, revenues, and experience. *Preq:* ED L 735.

**ED L 750 Field Experience in Elementary Administration and Supervision 3(1,4)** Practicum with an experienced elementary administrator or supervisor. May be repeated for a maximum of six credits. *Preq:* ED L 710.

**ED L 755 Field Experience in Secondary Administration and Supervision 3(1,4)** Practicum with an experienced secondary administrator or supervisor. May be repeated for a maximum of six credits. *Preq:* ED L 710.

**ED L 765 Assessment in Higher Education 3(3,0)** Outcomes assessment and institutional effectiveness movement including assessment techniques, instrument selection, analysis of assessment data, and reporting of assessment findings. *Preq:* Consent of instructor.

**ED L 795 School Leadership Information Systems 3(2,2)** Use of computers and related technologies for decision making by public school leaders; logistics of information management, sources of information, communication with technology, and integration of technology into the leadership function.

**ED L (ED F) 800 Philosophy, Schooling, and Educational Policy 3(3,0)** Development of contemporary educational theory and its impact on current schooling practices and educational policy development.



**ED L 805 Advanced Educational Leadership: Theory and Practice 3(3,0)** Principles and theories of leadership as practiced in the institutional setting. *Preq:* ED L 715, 730.

**ED L 810 Introduction to School Building Planning 3(2,2)** Planning of educational facilities from conception of need through utilization of facility. *Preq:* ED L 700.

**ED L 815 The Superintendency 3(3,0)** Current, in-depth study of the superintendency including relationships with school boards, faculty, staff, and community. For practicing and aspiring educational administrators. *Preq:* Admission to the Educational Specialist program or the doctoral program.

**ED L 820 Politics of Education 3(3,0)** Politics of education in the United States including the complex interrelationships among administrators, special interest groups, politicians, and knowledge brokers.

**ED L 830 Business Management in Education 3(2,3)** Fiscal management of individual schools and districts including budgeting, purchasing, and accounting for funds. *Preq:* ED L 725, 745.

**ED L 839 Research Methods in Educational Leadership 3(3,0)** Development of design, method, and procedures for conducting the educational specialist project. Course culminates in the completion and presentation of the project prospectus for approval by the instructor and the student's major advisor. *Preq:* ED L (ED F) 800, 805, 820, consent of instructor.

**ED L 840 Field Problems in School Administration and Supervision of Instruction 3(2,3)** Application of research techniques and practices in solution of field problems in school administration and supervision. *Preq:* ED F 778, ED L 700.

**ED L 850 Practicum in School System Administration and Supervision 3(1,4)** Practicum with an experienced school-system-level administrator or supervisor. May be repeated for a maximum of six credits. *Preq:* ED L (ED F) 800, 805, consent of instructor.

**ED L 855 Applied Research and Evaluation in Higher Education 3(3,0)** Basic issues of measurement emphasizing questionnaire development, scales, and measures commonly used in higher education research, assessment, and program evaluation.

**ED L 885 Selected Topics in Educational Administration 1-3(1-3,0)** Current literature and results of current research. Topics vary from year to year. May be repeated for a maximum of six credits.

**ED L 900 Principles of Educational Leadership 3(3,0)** Advanced leadership theory; the nature of leadership, major theories of leadership, and their application in educational organizations. *Preq:* Must have passed the preliminary examination in the PhD program in Educational Leadership.

**ED L 905 Theory and Practice in Educational Leadership 3(3,0)** Advanced organizational and leadership theory; major theories of organization and their applications in understanding the roles of governmental agencies in society. *Preq:* Admission to the doctoral program.

**ED L 910 Introductory Doctoral Seminar 3(3,0)** Educational leadership for beginning doctoral students providing an introduction to the conceptual and theoretical frameworks of educational leadership for both public school and higher education administration. *Preq:* Consent of instructor.

**ED L 915 Educational Planning 3(3,0)** Systems approach to planning and management; the measurement and interpretation of performance results.

**ED L 925 Instructional Leadership 3(3,0)** Preparation for a career in educational leadership; the principal's functions regarding the effective school's movement as incorporated in instructional leadership.

**ED L 935 History of Higher Education 3(3,0)** Development of higher education from the 11<sup>th</sup> century to the present with emphasis on the United States.

**ED L 950 Educational Policy Studies 3(3,0)** Critical analysis of the sources and nature of educational policy and how policy is developed, administered, and assessed for public schools. *Preq:* Admission to doctoral studies.

**ED L (VT ED) 955 The Two-Year College 3(3,0)** Historical developments, functions, organization, and administration of the two-year college. *Preq:* Admission to doctoral studies or consent of instructor.

**ED L 960 Legal Principles in the Administration of Institutions of Higher Education 3(3,0)** General principles of higher education law from the points of view of statute and common law practice. *Preq:* Admission to doctoral studies or consent of instructor.

**ED L 965 Higher Education Finance 3(3,0)** Higher education finance relative to sources of revenue, expenditures, and planning.

**ED L 970 Foundations of Higher Education 3(3,0)** Survey of American higher education including its historical, political, philosophical, and social aspects. *Preq:* Admission to doctoral studies.

**ED L 972 Ethics in Educational Leadership 3(3,0)** The ethical issues involved in administering educational institutions; moral leadership, ethical work environments, and decision-making models.

**ED L 976 External Effectiveness in Higher Education 3(3,0)** Optimum structures and strategies for fund raising, public relations, constituent relations, governmental affairs, and governing boards necessary for a college or university to communicate effectively with its constituents.

**ED L 980 Current Issues in Educational Leadership 1-3(1-3,0)** Topics and issues as determined by the needs of the students and the instructor. *Preq:* Graduate standing, consent of instructor.

**ED L 985 Internship in Educational Leadership 3(1,4)** Experience working in a chosen area of specialization in educational leadership, either in public schools or institutions of higher education, planned to build competence in the student's field of specialization. May be repeated for a maximum of six credits. To be taken Pass/Fail only. *Preq:* ED L 900, 905, 910, consent of advisor.

**ED L 989 Advanced Doctoral Seminar I 3(3,0)** Exploration of educational leadership topics. Culminates in the selection of a topic for presentation and approval and the development of Chapter I of a prospectus. To be taken Pass/Fail only. *Preq:* ED L 900, 905, 910, consent of instructor.

**ED L 990 Advanced Doctoral Seminar II 3(3,0)** Seminar for advanced students focusing on the preparation of dissertation Chapters I-III.

**ED L 991 Doctoral Dissertation Research 1-18**

**ED L 995 Directed Research 1-4(1-4,0)** Research option for graduate students to pursue a line of inquiry in education under the direction of faculty. Specific educational question is investigated and reported using appropriate methodology. To be taken Pass/Fail only. May be repeated for a maximum of four credits. *Preq:* Admission to doctoral studies or consent of instructor.

## ELECTRICAL AND COMPUTER ENGINEERING

**E C E 604 Semiconductor Devices 3(3,0)** Consideration of the principles of operation, external characteristics, and applications of some of the more important semiconductor devices available. *Preq:* E C E 320. *Coreq:* MTHSC 311 or 434.

**E C E 606 Introduction to Microelectronics Processing 3(3,0)** Microelectronic processing, MOS and bipolar monolithic circuit fabrication, thick and thin film hybrid fabrication, applications to linear and digital circuits, fundamentals of device design. *Preq:* E C E 320. *Coreq:* MTHSC 311 or 434.

**E C E 610 Modern Control Theory 3(3,0)** Introduction to modern control theory including fundamentals of matrix algebra, state space analysis and design, nonlinear systems, and optimal control. *Preq:* E C E 409.

**E C E 617 Elements of Software Engineering 3(3,0)** Foundations of software design, reasoning about software, the calculus of programs, survey of formal specification techniques, and design languages. *Preq:* E C E 329, MTHSC 419.

**E C E 618 Power System Analysis 3(3,0)** Study of power system planning and operational problems. Subjects covered include load flow, economic dispatch, fault studies, transient stability, and control of problems. System modeling and computer solutions are emphasized through class projects. *Preq:* E C E 360, 380.

**E C E 619 Electric Machines and Drives 3(3,0)** Performance, characteristics, and modeling of AC and DC machines during steady-state and transient conditions. Introduction to power electronics devices and their use in adjustable speed motor drives. *Preq:* E C E 321, 360, 380. *Coreq:* MTHSC 434 or consent of instructor.

**E C E 622 Electronic System Design I 3(2,2)** Emphasizes the application of theory and skills to the design, building, and testing of an electronic system with both analog and digital components. Application varies each semester. Extensive use is made of computer software tools in the design process. *Preq:* E C E 321, 330, 360, 371, 381.



- E C E 629 Organization of Computers 3(3,0)** Computer organization and architecture. Topics include a review of logic circuits, bus structures, memory organization, interrupt structures, arithmetic units, input-output structures, state generation, central processor organization, control function implementation, and data communication. Registered Transfer Language (RTL) for description and design of digital systems. *Preq:* E C E 272 or consent of instructor.
- E C E 630 Digital Communications 3(3,0)** Study of digital communication systems. Topics include error-control coding, synchronization, multiple-access techniques, spread spectrum signaling, and fading channels. *Preq:* E C E 427.
- E C E 631 Digital Electronics 3(2,2)** Electronic devices and circuits of importance to digital computer operation and to other areas of electrical engineering are considered. Active and passive waveshaping, waveform generation, memory elements, switching, and logic circuits are some topics. Experimentation with various types of circuits is provided by laboratory projects. *Preq:* E C E 321. *Coreq:* MTHSC 311 or 434.
- E C E 632 Instrumentation 3(3,0)** Theory and analysis of transducers and related circuits and instrumentation. Generalized configurations and performance characteristics of instruments are considered. Transducer devices for measuring physical parameters such as motion, force, torque, pressure, flow, and temperature are discussed. *Preq:* E C E 321. *Coreq:* MTHSC 311 or 434.
- E C E 636 Microwave Circuits 3(3,0)** Analysis of microwave networks comprising transmission lines, waveguides, passive elements, interconnects, and active solid state microwave circuits. Use of modern CAD tools to design RF/Microwave passive/active networks. Fabrication of typical circuits. *Preq:* E C E 381 or equivalent. *Coreq:* MTHSC 311 or 434.
- E C E 638 Computer Communications 3(3,0)** Digital data transmission techniques, modems and communications channels, communications software and protocols, multiprocessors, and distributed processing; concurrency and cooperation of dispersed processors. *Preq:* Senior standing in Electrical or Computer Engineering or Computer Science or consent of instructor.
- E C E 639 Fiber Optics 3(3,0)** Underlying principles of design for optical fibers in practical systems are covered. Optical fiber as a waveguide is examined using wave optics and ray optics. Design criteria for using mono- and multi-mode fibers are discussed. Other topics include fabrication, and measurement. *Preq:* E C E 381. *Coreq:* MTHSC 434 or consent of instructor.
- E C E 640 Performance Analysis of Local Computer Networks 3(3,0)** Introduction to design and performance analysis of local computer networks. Emphasis is on performance analysis of representative multi-access procedures. Three common types of networks are considered in detail. *Preq:* E C E 272, 317.
- E C E 642 Knowledge Engineering 3(3,0)** Introduction to theoretical and practical aspects of knowledge engineering or applied artificial intelligence. Topics include symbolic representation structures and manipulation, unification, production systems and structures, rule-based and expert systems, planning and AI system architectures; system design in PROLOG and LISP. Project is required. *Preq:* E C E 329, 352.
- E C E 646 Antennas and Propagation 3(3,0)** Study of the theoretical and practical aspects of antenna design and utilization, input impedances, structural considerations, and wave propagation. *Preq:* E C E 330, 381 or 436; MTHSC 311 or 434.
- E C E 655 Robot Manipulators 3(3,0)** Analysis of robot manipulator systems with special focus on interaction of these technologies with society. Emphasis is on rigid-link robot manipulator systems. Topics include history of robot technology, kinematics, dynamics, control, and operator interfaces. Case studies reinforce impact of robot technology on society and vice versa. *Preq:* MTHSC 206, 311, or consent of instructor.
- E C E (M E) 656 Fundamentals of Robotics 3(3,0)** See M E 656.
- E C E 659 Integrated Circuit Design 3(2,2)** Design concepts and factors influencing the choice of technology; fundamental MOS device design; silicon foundries, custom and semicustom integrated circuits; computer-aided design software/hardware trends and future developments; hands-on use of CAD tools to design standard library cells; systems design considerations, testing, and packaging. *Preq:* E C E 321. *Coreq:* MTHSC 311 or 434.
- E C E 667 Introduction to Digital Signal Processing 3(3,0)** Introduction to characteristics, design, and applications of discrete time systems; design of digital filters; Fast Fourier Transform (FFT); LSI hardware for signal processing applications. *Preq:* E C E 330.
- E C E 668 Embedded Computing 3(2,2)** Principles of using computing in the larger context of a system. Topics include bus and processor design types (e.g. microprocessor, microcontroller, DSP), codecs, digital circuit power management, real time scheduling, and embedded operating systems. Lab work consists of projects on embedded hardware (e.g. PC-104+). *Preq:* E C E 371, CP SC 212; or consent of instructor.
- E C E 692 Special Problems 1-3** Special assignment in electrical or computer engineering. Typical assignments include computer programs, term papers, technical literature searches, hardware projects, and design project leadership. May be taken only once for credit.
- E C E 693 Selected Topics 1-3(1-3,0)** Classroom study of current and new technical developments in electrical and computer engineering. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.
- E C E 701 Master of Engineering Design Project 1-6** Practical problems in engineering analysis and design culminating in the written report required for the MEng degree. To be taken Pass/Fail only. May be repeated for a maximum of six credits.
- E C E 801 Analysis of Linear Systems 3(3,0)** Foundations of linear system analysis; matrix algebra, linear graph theory, and operational mathematics applied to formulation and solution of system equations in time and frequency domains.
- E C E 802 Electric Motor Control 3(3,0)** Dynamic modeling and analysis of electrical machines for design of AC and DC drive systems; implementation of such models on a digital computer; voltage-fed inverters; pulse width modulation and analysis techniques for inverters; harmonic generation and reduction. *Preq:* E C E 434.
- E C E 804 Methods of Applied Optimization and Optimum Control 3(3,0)** Methods of optimizing systems with and without dynamics including linear programming, nonlinear programming, integer programming, gradient and variational calculus, minimum principle, principle of optimality, and dynamic programming. *Coreq:* MTHSC 653.
- E C E 805 Methods of State and Parameter Estimation of Stochastic Systems 3(3,0)** State and parameter estimations of both linear and nonlinear continuous-time and discrete-time systems including model identification: Kalman and Wiener filters, fixed-interval, fixed-point and fixed-lag smoothers, stochastic approximation estimation, nonlinear estimation by statistical linearization, and sensitivity analysis of Kalman filters. *Coreq:* MTHSC 654.
- E C E 807 Computer Methods for Power Systems Analysis 3(3,0)** Electric power system operation; development of models of transmission line components and networks; computer methods for solving linear and nonlinear systems of network equations; operating problems in load flow, scheduling and economic dispatch. *Preq:* E C E 418.
- E C E 811 Integrated Circuit Design 3(2,2)** Design concepts and factors influencing the choice of technology; fundamental MOS device design; silicon foundries; custom and semi-custom integrated circuits; computer-aided design software/hardware trends and future developments; the hands-on use of CAD tools to design MOS standard cells; systems design, testing, and packaging. *Preq:* E C E 459.
- E C E 816 Electric Power Distribution System Engineering 3(3,0)** Radial circuit analysis techniques, feeder and transformer modeling, load modeling, loss minimization and voltage control, causes of power quality problems, motor starting analysis, strategies for analyzing impacts of disturbances. *Preq:* E C E 418, 419, or consent of instructor.
- E C E 817 Power System Transients 3(3,0)** Electrical transients in power systems; frequency domain and time domain techniques for power systems transient analysis; capacitor switching, load switching, fault-induced transients, line reclosing, and single pole switching. *Preq:* Consent of instructor.



**E C E 818 Random Process Applications in Engineering 3(3,0)** Theory of random processes emphasizing engineering applications; stochastic convergence and limit theorems; martingales; mean-square calculus; Karhunen-Loeve expansions; systems with stochastic inputs; Poisson processes; shot noise; Weiner processes; white noise processes; Markov systems; queuing systems; and estimate theory. *Preq:* E C E 317 and 330 or consent of instructor.

**E C E 819 Detection and Estimation Theory 3(3,0)** Theory of statistical testing of hypotheses applied to detection and estimation of communication signal parameters; detection of signals with random amplitude, phase, and arrival time in noise; detection of single and multiple observation; estimates and their properties; signal resolution. *Preq:* E C E 820.

**E C E 820 Digital Communication Systems I 3(3,0)** Modern communications systems emphasizing modulation and methods of taking into account effects of noise on various systems. *Preq:* E C E 428 or equivalent.

**E C E 821 Digital Communication Systems II 3(3,0)** Continuation of E C E 820.

**E C E 822 Information Theory 3(3,0)** Statistical problems encountered in information handling; relations of probability, information, and coding theory; unified treatment of set theory, sample space, random variables, information measure, and capacity applied to communication.

**E C E 823 Integrated Circuit Technology 3(3,0)** Physical and chemical principles underlying the major processing operations used in the fabrication of integrated circuit semiconductor devices, process simulation, diagnostic testing, and factors affecting device yield and reliability. *Preq:* Consent of instructor.

**E C E 824 Power System Protection 3(3,0)** Coordination of power system protection components including microprocessor based relay-adaptive protection of power system, power system disturbance identification and system restoration following a major disturbance. *Preq:* E C E 418 or consent of instructor. *Coreq:* MTHSC 434 or consent of instructor.

**E C E 825 Solid-State Electronics 3(3,0)** Modern physics approach to electrons in solids; elementary quantum mechanics; statistics; plasmas; band theory; application of these principles to modern amplifiers; e.g., the traveling-wave tube, tunnel diode, masers, and parametric amplifiers.

**E C E 829 Special Functions in Engineering 3(3,0)** Complex calculus and analytic functions; origin of special functions in engineering; series and integral representations of special functions; properties and applications of gamma, Bessel, Legendre, Chebyshev, etc. functions; computation of special functions; applications in selected engineering problems. *Preq:* Consent of instructor.

**E C E 830 Electromagnetics 3(3,0)** Wave equations and waves, electromagnetic potentials, theorems and advanced concepts, guided waves, radiation, boundary value problems, and simple Green's functions. *Preq:* E C E 380, 381; or equivalent.

**E C E 831 Advanced Electromagnetic Theory 3(3,0)** Advanced boundary-value problems in cylindrical and spherical coordinates, special functions, Sommerfeld integrals, Green's functions, and integral equations. *Preq:* E C E 830.

**E C E 834 Asymptotic Methods and Diffraction Theory 3(3,0)** Canonical diffraction problems for which exact solutions are available; asymptotic reevaluation of these solutions in terms of incident, reflected and diffracted rays leads to Keller's postulates for an extended theory or geometrical theory of diffraction; application of diffraction from edges and curved surfaces to scattering and antenna problems. *Preq:* E C E 830.

**E C E 835 Finite Element Methods in Electromagnetics 3(3,0)** Finite-element methods (FEM) as applied to electromagnetics; fundamentals of list-linked FEM data structures, sparse matrix solutions, edge-based vector bases, radiation boundary conditions, and perfectly absorbing media. *Coreq:* E C E 830.

**E C E 836 Microwave Circuits and Systems 3(3,0)** Application of the mathematics and physical principles of electromagnetic field theory and electrical circuit analysis to the geometries that are of interest in modern microwave engineering; transmission lines, waveguides, discontinuities, interconnection of multiports, and periodic structures. *Preq:* E C E 436. *Coreq:* E C E 830.

**E C E 837 Advanced Antenna Theory 3(3,0)** The antenna as a radiating and receiving device; examination by classical and numerical techniques of the relations between structure and performance, gain and terminal conditions. *Preq:* E C E 446. *Coreq:* E C E 830.

**E C E 838 Special Topics in Electromagnetics 1(1,0)** Methods of solving selected electromagnetic problems with emphasis on Green's functions, equivalence principle, dynamic potential theory, and boundary value techniques. May be repeated for credit. *Preq:* Consent of instructor.

**E C E 839 Integral Equations in Electromagnetics 3(3,0)** Integral equation formulation in electromagnetics, solution techniques, moment methods, and application to practical problems. *Preq:* E C E 830 or consent of instructor.

**E C E 840 Physics of Semiconductor Devices 3(3,0)** Semiconductor device physics emphasized rather than circuits; detailed analysis of the p-n junction, traps, surface states and conduction processes, and devices; analysis and models of Schottky diode, MIS diode, MOSFET, charge couples devices, and solar cells; charge control concepts, transit time effects, surface-type devices and practical aspects of device process. *Preq:* E C E 404, 406.

**E C E 842 Computer Architecture 3(3,0)** Fundamental issues that arise in the composition of logic elements into computer systems; design and analysis of processors, busses, memory hierarchies, communications controllers, and associated software. *Preq:* E C E 429 or equivalent.

**E C E 844 Digital Signal Processing 3(3,0)** Digital filter design; discrete Hilbert transforms; discrete random signals; effects of finite register length in digital signal processing; homomorphic signal processing; power spectrum estimation; speech processing, radar, and other applications. *Preq:* E C E 467.

**E C E 845 Computer System Design and Operation 3(3,0)** Factors involved in design, acquisition, and operation of a computer system; analysis methods; alternative computer systems; computer economics; performance evaluation; operational requirements. *Preq:* Consent of instructor.

**E C E 846 Digital Processing of Speech Signals 3(3,0)** Application of digital signal processing techniques to problems related to speech synthesis, recognition, and communication; digital models and representations of speech wave forms; Fourier analysis; homomorphic processing; linear predictive coding; algorithms for recognizing isolated words and continuous speech; man-machine communications by voice. *Preq:* E C E 467.

**E C E 847 Digital Image Processing 3(3,0)** Digital image fundamentals; comparison of image transforms including KL, Fourier, Walsh, Hadamard, cosine, and slant; image data, compression techniques; image enhancement algorithms; image restoration; image encoding process; image segmentation, and description. *Preq:* E C E 467.

**E C E 848 Telecommunication Network Modeling and Analysis 3(3,0)** Protocols, modeling, and analysis of telecommunication networks with emphasis on quantitative performance modeling of networks and systems using packet switching and circuit switching techniques. *Preq:* CP SC 825 or E C E 438.

**E C E 849 Advanced Topics in Computer Communications 3(3,0)** Performance analysis and design of computer communication networks with emphasis on recent developments; routing flow control, error control, and end-to-end performance analysis, local area, packet radio, and long haul store-and-forward networks. *Preq:* E C E 438 or 440, consent of instructor.

**E C E 850 Computation and Simulation 3(3,0)** Computer modeling as related to engineering problems; matching problems and computers to obtain most effective solution.

**E C E 851 Advanced Topics in Computer Architecture 3(3,1)** Analysis and design of multiprocessor and modular computer systems; recent developments in integration, fabrication, and application of multiprocessor systems. *Preq:* E C E 842.

**E C E 852 Software Engineering 3(3,0)** Design, construction verification, and testing of large-scale computer software systems; software science, requirements writing, design graphics, the calculus of programs, verification proofs, and symbolic execution. *Preq:* Computer Engineering major or consent of instructor.

**E C E (M E) 854 Analysis of Robotic Systems 3(3,0)** Methods of designing and operating robotics systems for advanced automation; on-line identification and description of 3-D objects by digitized images; off-line collision-free path planning and on-line collision avoidance traveling using artificial intelligence. *Preq:* ME (E C E) 456 or consent of instructor.



**E C E 855 Artificial Intelligence 3(3,0)** Emulating intelligent behavior by computer; models of cognitive processes; logical foundations; constraint satisfaction problems; natural language understanding; pattern-directed inference and chaining paradigms; goal-directed behavior, planning, and search; learning; advanced database structure and inference strategies; examples of LISP, PROLOG, and OPS5. *Preq:* E C E 442.

**E C E 856 Pattern Recognition 3(3,0)** Several approaches to general pattern recognition problems with practical computer-oriented applications; feature extraction; classification algorithms; discriminant functions; learning schemes; statistical methods; information theoretic approaches; applications; current developments.

**E C E 857 Coding Theory 3(3,0)** Principles of algebraic coding and its application to transmission of information over noisy communications channels; introduction to abstract algebra; code performance bounds; code representations; linear codes of the Hamming and Bose-Chandhuri types and burst-error correcting codes; problems of implementation and decoding. *Preq:* E C E 317 or equivalent.

**E C E (M E) 859 Intelligent Robotic Systems 3(3,0)** Integration and fusion of data from multiple sensors on multiple robots; intelligent decision making on motion planning and execution based on sensed data involving mutual compliance; simultaneous force and position controls using computers. *Preq:* E C E (M E) 854.

**E C E 860 Advanced Coding Theory 3(3,0)** Introduction to convolutional codes and trellis-coded modulation. Topics include code generation and representation, distance properties, decoding techniques, performance analysis, multidimensional codes and lattice theory, and coding for fading channels; applications to wireline communications and mobile communications. *Preq:* E C E 828, 857.

**E C E 862 Real Time Computer Application in Power Systems 3(3,0)** Principles of monitoring, control, and operation of power systems; load frequency control, on-line load flow, power system state estimation, unit commitment, and load forecasting. *Preq:* E C E 418.

**E C E 863 Power System Dynamics and Stability 3(3,0)** Modeling of synchronous machines and their control systems; power system stability for small and large disturbances; excitation systems, governor control, power system stabilizers, and state variables formulation for power systems dynamic stability studies. *Preq:* E C E 418, 419.

**E C E 869 Advanced Kinematics in Robotics 3(3,0)** Complex robotic systems, such as multi-fingered robot hands, dual-armed robots and multi-joint "snakelike" robots; kinematic redundancy, load distribution, and dexterous manipulation; effective modeling and solution techniques for these types of underconstrained systems. *Preq:* E C E 409, M E (E C E) 656, or consent of instructor.

**E C E 872 Artificial Neural Networks 3(3,0)** Design, analysis, and application of artificial neural networks, neuron models, network architectures, training (supervised and unsupervised), and hardware implementation; extended studies of selected applications and simulation exercises. *Preq:* MTHSC 311 or consent of instructor, graduate standing.

**E C E 873 Parallel and Distributed Systems 3(3,0)** Design, analysis, and evaluation of algorithms for parallel and distributed computer systems; time complexity, speedup, efficiency, and isoefficiency; communication costs; numerical algorithms including solving systems of equations (both sparse and dense) as well as symbolic algorithms; substantial parallel programming projects.

**E C E 874 Advanced Nonlinear Control 3(3,0)** Basics of nonlinear control based on Lyapunov techniques; adaptive control design, robust control design, and observer design; understanding and development of Lyapunov control design tools. *Preq:* E C E 801 or equivalent.

**E C E 890 Engineering Report Research 1-3** Research culminating in writing an engineering report to satisfy one of the requirements for the nonthesis option for the MS degree. To be taken Pass/Fail only.

**E C E 891 Master's Thesis Research 1-12**

**E C E 892 Special Problems in Electrical and Computer Engineering 1-3(1-3,0)** Term paper, special design, or other problems in electrical and computer engineering approved by the instructor. May not be used for investigation associated with the MS thesis or the engineering report. May be repeated for credit.

**E C E 893 Selected Topics in Electrical and Computer Engineering 1-3(1-3,0)** Topics not covered in other courses; current literature and results of current research. Topics vary from year to year in keeping with developments in the field. May be repeated for credit. *Preq:* Consent of instructor.

**E C E 903 Computer Architecture Seminar 1(1,0)** Recent research publications related to computer architecture including parallel systems, distributed computing, reconfigurable architectures, and software development for high performance computing. Students read and discuss one research paper weekly and present one research paper each semester. May be repeated for a maximum of three credits. *Preq:* Consent of instructor.

**E C E 991 Doctoral Dissertation Research 1-12**

## ELEMENTARY EDUCATION

**ED EL 760 Curriculum Development in the Elementary School 3(3,0)** Analysis of trends and practices relative to elementary curriculum planning. Designed to develop an understanding of the essential elements of curriculum decisions followed by the process of improving the curriculum. *Preq:* ED F 701, 702, or consent of instructor.

**ED EL 804 Advanced Methods of Teaching in the Elementary School 3(3,0)** Principles and practices involved in promoting effective learning in elementary schools; analysis and evaluation of educational models and research. *Preq:* ED EL 760 or consent of instructor.

**ED EL 826 Advanced Methods in Elementary Science Teaching 3(3,0)** Provides in-depth study of current research and trends in elementary science teaching methods and curriculum development. Students examine recent literature and standards for science teaching and develop strategies to implement recommended practices in their own classrooms. *Preq:* Admission to MEd program or consent of instructor.

**ED EL 831 Advanced Methods in Elementary School Social Studies Education 3(3,0)** Techniques, resources/materials, theories, and research for teaching social studies in the elementary/middle school classroom; current research trends in social studies education, national, and state standards, addressing the needs of a diverse student population, fostering a classroom community, and developing an integrated approach to social studies education. *Preq:* Admission to the MEd program or consent of instructor.

**ED EL 890 Education Research Project 3(2,3)** Students select, with approval of professor, and conduct research on an education issue of suitable scope. Oral, written, and visual presentation of the research project is required. Students must enroll during final semester. *Preq:* Consent of instructor.

**ED EL 892 Advanced Methods in Elementary School Mathematics 3(3,0)** Research-based course which examines trends in mathematics teaching and learning and the relationship between theory and practice; developing appropriate teaching strategies; analysis and evaluation of educational models and research; and improving staff development based on current research. *Preq:* Admission to MEd program or consent of instructor.

**ED EL 937 Designing Elementary Curriculum 3(3,0)** Theoretical issues and guidelines for educators engaged in the curriculum development process at the elementary level. *Preq:* Admission to the PhD program in Curriculum and Instruction, ED 954, 955, 956.

**ED EL 938 Teacher as Researcher 3(3,0)** Various methodologies of field-based research. Students complete a literature review and design a field-based research project. *Preq:* Admission to the PhD program in Curriculum and Instruction, ED 878, 879, EX ST 801, one of the following: EDSEC 846, 847, 848, 849, READ 944.

## ENGINEERING GRAPHICS

**E G 612 Interactive Computer Graphics 3(3,0)** Graphics hardware and display technology; reduction and presentation of engineering data; techniques of geometrical transformations, perspective, and model manipulation; methodology of computer-aided design; application of higher-level software to engineering problems. *Preq:* E G 208 and MTHSC 208 or consent of instructor.

**E G 690 Special Topics in Engineering and Computer Graphics 1-3(1-3,0)** Comprehensive study of any computer-aided topic in engineering graphics not covered in other courses. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.

**E G 823 Computer-Aided Geometric Modeling 3(3,0)** Shape modeling and design by computer; curve and surface representation; methods of solid modeling by computer; data base representation and integral properties of solid models.



## ENGLISH

**ENGL 600 The English Language 3(3,0)** Studies in English usage and historical development of the language. *Preq:* ENGL 310 or consent of instructor.

**ENGL 601 Grammar Survey 3(3,0)** Survey of modern grammars, focusing on the impact of structural grammar on traditional grammar. Recommended for English teachers. *Preq:* ENGL 310 or consent of instructor.

**ENGL 607 The Medieval Period 3(3,0)** Selected works of Old and Middle English literature, excluding Chaucer. *Preq:* ENGL 310 or consent of instructor.

**ENGL 608 Chaucer 3(3,0)** Selected readings in Middle English from *The Canterbury Tales* and other works by Chaucer. *Preq:* ENGL 310 or consent of instructor.

**ENGL 610 Drama of English Renaissance 3(3,0)** Selected readings in non-Shakespearean dramatic literature of the 16<sup>th</sup> and 17<sup>th</sup> centuries. *Preq:* ENGL 310 or consent of instructor.

**ENGL 611 Shakespeare 3(3,0)** Study of selected tragedies, comedies, and history plays of Shakespeare. Required of all English majors. *Preq:* ENGL 310 or consent of instructor.

**ENGL 614 Milton 3(3,0)** Development of Milton's art and thought from the minor poems and selected prose through *Paradise Lost*, *Paradise Regained*, and *Samson Agonistes*, set against the background of the late Renaissance. *Preq:* ENGL 310 or consent of instructor.

**ENGL 615 The Restoration and Eighteenth Century 3(3,0)** Readings in Dryden, Swift, Pope, and Dr. Johnson. *Preq:* ENGL 310 or consent of instructor.

**ENGL 616 The Romantic Period 3(3,0)** Readings from the poetry and critical prose of Blake, Wordsworth, Coleridge, Byron, Shelley, Keats, and other representative figures. *Preq:* ENGL 310 or consent of instructor.

**ENGL 617 The Victorian Period 3(3,0)** Readings from the poetry and nonfiction prose of selected Victorian authors, including works of Carlyle, Tennyson, Browning, Arnold, and other representative figures. *Preq:* ENGL 310 or consent of instructor.

**ENGL 618 The English Novel 3(3,0)** Study of the English novel from its 18<sup>th</sup> century beginnings through the Victorian period. *Preq:* ENGL 310 or consent of instructor.

**ENGL 619 Post-Colonial Studies 3(3,0)** Selected readings in post-colonial literature and theory, focusing on issues of nationalism, migration, resistance, race, language, and master narratives. *Preq:* ENGL 310 or consent of instructor.

**ENGL 625 The American Novel 3(3,0)** Survey of the most significant forms and themes of the American novel from its beginnings to 1900. *Preq:* ENGL 310 or consent of instructor.

**ENGL 626 Southern Literature 3(3,0)** Intellectual and literary achievement of the South from 1607 to the present, with emphasis upon the writers of the 19<sup>th</sup> century. *Preq:* ENGL 310 or consent of instructor.

**ENGL 627 Agrarianism and the Humanistic Tradition 3(3,0)** Focuses on the importance of agriculture and rural life to the humanistic tradition of Western Civilization from antiquity through the early years of the American republic. *Preq:* ENGL 310 or consent of instructor.

**ENGL 628 Contemporary Literature 3(3,0)** Focuses on American, British, and other fiction, poetry, and drama from the Post-World War II to the present. *Preq:* ENGL 310 or consent of instructor.

**ENGL 629 Dramatic Literature I 3(3,0)** Selected reading in dramatic literature from the classical era of Greece and Rome to the Renaissance. *Preq:* ENGL 310 or consent of instructor.

**ENGL (THEA) 630 Dramatic Literature II 3(3,0)** Principles and progress of drama from the Restoration to the present; analysis of representative plays; critical reports; discussion of trends in dramatic literature. *Preq:* ENGL 310 or consent of instructor.

**ENGL 631 Modern Poetry 3(3,0)** The modern tradition in English and American poetry from Yeats to the present; relevant critical essays. *Preq:* ENGL 310 or consent of instructor.

**ENGL 632 Modern Fiction 3(3,0)** American and British novels and short stories of the 20<sup>th</sup> century. *Preq:* ENGL 310 or consent of instructor.

**ENGL 633 The Anglo-Irish Literary Tradition 3(3,0)** Exploration of the unique literary heritage and achievement of English-language Irish writers in the 19<sup>th</sup> and 20<sup>th</sup> centuries. Major figures of the Irish tradition: W. B. Yeats, James Joyce, Samuel Beckett, and other writers; consideration of the specifically Irish aspects of their works. *Preq:* ENGL 310 or consent of instructor.

**ENGL 634 Environmental Literature 3(3,0)** Survey of literature that examines the relationship between human beings and the natural world, including analysis of environmental themes in myths and legends and in selected poetry and prose of 19<sup>th</sup>- and 20<sup>th</sup>-century England and America. *Preq:* ENGL 310 or consent of instructor.

**ENGL 635 Literary Criticism 3(3,0)** Major critical approaches to literature. *Preq:* ENGL 310 or consent of instructor.

**ENGL 636 Feminist Literary Criticism 3(3,0)** Introduction to the germinal works of feminist literary theory and criticism. Outlines the development of modern literary criticism by studying feminist versions of the major critical methodologies. *Preq:* ENGL 310 or consent of instructor.

**ENGL 637 Directed Studies 1-3(1-3,0)** Class and tutorial work for students with special interests or projects in American, British, or European literature outside the scope of existing courses. Applications must be approved during the registration period of the semester preceding the one in which directed studies will occur. May be repeated by arrangement with the department. *Preq:* ENGL 310 or consent of instructor.

**ENGL 640 Literary Theory 3(3,0)** Examination of how approaches such as Marxism, Psychoanalysis, Feminism, Deconstruction, New Historicism, Post-Colonialism, Cultural Studies, and Queer Theory answer the question, "What is literature?" *Preq:* ENGL 310 or consent of instructor.

**ENGL 642 Cultural Studies 3(3,0)** Investigation of the similarities and connections between a wide variety of cultural products, events, and practices—from fast food through opera to on-line shopping—using theories ranging from Marxism to hybridity. *Preq:* ENGL 310 or consent of instructor.

**ENGL 644 Renaissance Literature 3(3,0)** Selected readings in non-Shakespearean British literature from 1500–1660. Includes drama, poetry, and prose. *Preq:* ENGL 310 or consent of instructor.

**ENGL 645 Fiction Workshop 3(3,0)** Workshop in the creative writing of prose fiction. May be repeated once for credit. *Preq:* ENGL 310 or consent of instructor.

**ENGL 646 Poetry Workshop 3(3,0)** Workshop in the creative writing of poetry. May be repeated once for credit. *Preq:* ENGL 310 or consent of instructor.

**ENGL (THEA) 647 Playwriting Workshop 3(0,3)** See THEA 647.

**ENGL 648 Screenwriting Workshop 3(2,3)** Workshop in the creative writing of screenplays. May be repeated once for credit. *Preq:* ENGL 310 or consent of instructor.

**ENGL 650 Film Genres 3(2,3)** Advanced study of films that have similar subjects, themes, and techniques, including such genres as the Western, horror, gangster, science fiction, musical, and/or screwball comedy. Also considers nontraditional genres, screen irony, genre theory, and historical evolution of genres. Topics vary. *Preq:* ENGL 310 or consent of instructor.

**ENGL (COMM) 651 Film Theory and Criticism 3(2,3)** Advanced study into the theory of film/video making emphasizing understanding a variety of critical methods to approach a film. Examines the history of film theory and defines the many schools of film criticism, including realism, formalism, feminism, semiotics, Marxism, and expressionism. *Preq:* ENGL 310 or consent of instructor.

**ENGL 652 Great Directors 3(2,3)** Intensive study of one to three film directors with an emphasis on understanding the entire canon of each director. Students study similarities in techniques, shifts in thematic emphasis, and critical methodologies for approaching the works of each director. Topics vary. *Preq:* ENGL 310 or consent of instructor.

**ENGL 653 Sexuality and the Cinema 3(2,3)** Examination of male/female sexual roles and their evolution in American genre films, avant-garde cinema, and international films. Includes the study of movies in relation to cultural values and social stereotypes, introduction to feminist film theory, and consideration of film pornography. *Preq:* ENGL 310 or consent of instructor.

**ENGL 655 American Humor 3(3,0)** Native American humor of the 19<sup>th</sup> and 20<sup>th</sup> centuries. *Preq:* 310 or consent of instructor.

**ENGL (HUM) 656 Literature and Arts of the Holocaust 3(3,0)** Addresses the Holocaust through literature, art, architecture, music, and film. Beginning with historical, political, and economic forces that contributed to the Holocaust, course then focuses on highly diverse creative responses to this event—responses that often reflect the difficulties and politics of these commemorative gestures. *Preq:* ENGL 310 or consent of instructor.



- ENGL 659 Advanced Special Topics in Language, Literature, or Culture 3(3,0)** Advanced studies in topics not central to other English courses, such as certain authors, works, genres, themes, or areas of knowledge and culture. Specific topics are announced when offered. May be repeated once for credit with department chair's consent. *Preq:* ENGL 310 or consent of instructor.
- ENGL 663 Topics in American Literature 3(3,0)** Selected readings in American literature from a variety of time periods for focused study of authors, movements, themes, critical approaches, and genres specific to the American experience. Topics vary and are constructed by individual faculty. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* ENGL 310 or consent of instructor.
- ENGL 664 Topics in British Literature I 3(3,0)** Selected readings in British literature to the Romantics for focused study of authors, movements, themes, critical approaches, and genres specific to the British experience. Topics vary and are constructed by individual faculty. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* ENGL 310 or consent of instructor.
- ENGL 665 Topics in British Literature II 3(3,0)** Selected readings in British literature from the Romantics to the present for focused study of authors, movements, themes, critical approaches, and genres specific to the British experience. Topics vary and are constructed by individual faculty. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* ENGL 310 or consent of instructor.
- ENGL 675 Writing for Electronic Media 3(3,0)** Workshop in new forms of writing and hypertextual design for interactive electronic media. May be repeated once for credit at the undergraduate level. *Preq:* ENGL 310 or consent of instructor.
- ENGL 678 Digital Literacy 3(3,0)** Examines how electronic texts differ from and resemble print texts. Includes reading, studying, and analyzing print and digital texts to determine how digital techniques change patterns of reading and how readers make sense of electronic texts. *Preq:* ENGL 310 or consent of instructor.
- ENGL 682 African American Fiction and Non-fiction 3(3,0)** Critical examination of the various forms and genres of African American prose including the novel, short fiction, autobiography, nonfiction, and oratory with some attention to emerging theories about African American culture and its impact on American cultural life in general. *Preq:* ENGL 310 or consent of instructor.
- ENGL 683 African American Poetry, Drama, and Film 3(3,0)** Studies in the various forms, themes, and genres of African American poetry, drama, and film with some attention to emerging theories about African American culture and its impact on American cultural life in general. *Preq:* ENGL 310 or consent of instructor.
- ENGL 685 Composition for Teachers 3(3,0)** Practical training in teaching composition: finding workable topics, organizing and developing observations and ideas, evaluating themes, and creative writing. *Preq:* ENGL 310 or consent of instructor.
- ENGL 688 Genre and Activity Theory 3(3,0)** Examination of the forms that texts take, of the print and digital media in which they are composed, and of the ways they circulate among experts, in the public, and around the world. *Preq:* Junior standing.
- ENGL 689 Special Topics in Writing and Publication Studies 3(3,0)** Selected readings from topics in writing and publication studies, emphasizing areas such as major theories, practices, research, and critical approaches. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* ENGL 310 or consent of instructor.
- ENGL 690 Advanced Technical and Business Writing 3(3,0)** Advanced work in writing proposals, manuals, reports, and publishable articles. Students produce work individually and in groups. *Preq:* ENGL 310 or consent of instructor.
- ENGL (COMM) 691 Classical Rhetoric 3(3,0)** Study of the major texts in classical rhetoric. Examines the nature and functions of rhetoric in Greek and Roman societies. Traces the development of rhetoric from Protagoras through Isocrates, Plato, Aristotle, Cicero, and Quintilian and considers questions essential to understanding persuasive theory and practices. *Preq:* ENGL 310 or consent of instructor.
- ENGL (COMM) 692 Modern Rhetoric 3(3,0)** Examines the "new rhetorics" of the 20<sup>th</sup> century, which are grounded in classical rhetoric but which include findings from biology, psychology, linguistics, and anthropology, among other disciplines. Considers the theories and applications of communication. *Preq:* ENGL 310 or consent of instructor.
- ENGL 694 Writing About Science 3(3,0)** Advanced work in scientific writing and editing for peer and lay audiences. *Preq:* ENGL 310 or consent of instructor.
- ENGL 695 Technical Editing 3(3,0)** Practical experience in editing and preparing technical manuscripts for publication. General introduction to the functions of the technical editor. *Preq:* ENGL 310 or consent of instructor.
- ENGL 698 Studio Composition and Communication 3(3,0)** Preparation for students to work in the Class of 1941 Studio for Student Communication. *Preq:* Sophomore standing or consent of instructor.
- ENGL 700 Children's Literature for Teachers 3(3,0)** Literature for preschool through junior high.
- ENGL 800 Introduction to Research 1(1,0)** Literary history and research; use of libraries and bibliographical tools; exposition of scholarship. Required of all candidates for the Master of Arts degree and Master of Education degree with a concentration in Secondary Education–English.
- ENGL 801 Topics in Composition 3(3,0)** Principal theories and practices in modern grammar, stylistics, and semantics related to teaching composition.
- ENGL 802 Topics in Literary Genres 3(3,0)** Principal literary genres.
- ENGL 803 Topics in Rhetorical Theory 3(3,0)** Major rhetorical theories, figures, and historical movements.
- ENGL (COMM) 804 Fundamentals of Health Communication 3(3,0)** Fundamentals of health communication and the Health Communication Certificate; two theoretical bases underlying this interdisciplinary program in health communication, one based on social science theory and one based on humanities, i.e. rhetorical theory; history of both theoretical bases. *Preq:* Graduate standing or consent of Health Communication Coordinator.
- ENGL 805 Topics in Medieval Literature 3(3,0)** Principal works in verse and prose from c. 1100–1500.
- ENGL 806 Medical Rhetoric and Writing 3(3,0)** Issues in medical writing and health communication, including writing for visual and electronic media; general and specific forms and documents for professional writers in health professions. *Preq:* Graduate standing or consent of Health Communication Coordinator.
- ENGL (COMM) 807 Health Communication Campaign Planning and Evaluation 3(3,0)** Application of theories, practices, and tools developed in ENGL 804 and 806 to planning, implementing, and evaluating a public health campaign that targets a particular health practice. *Preq:* ENGL 804 and 806 or consent of Health Communication Certificate Coordinator.
- ENGL 808 Topics in Renaissance and Restoration Literature 3(3,0)** Principal works in verse and prose from c. 1500–1700.
- ENGL 811 Topics in Neoclassic and Romantic Literature 3(3,0)** Principal works in verse and prose from c. 1700–1832.
- ENGL 814 Topics in Victorian and Modern British Literature 3(3,0)** Principal works in verse and prose from c. 1832 to present.
- ENGL 820 Topics in American Literature to 1865 3(3,0)** Significant authors; works in poetry and prose; literary-intellectual movements such as Puritanism, the enlightenment, romanticism, and transcendentalism from c. 1607–1865.
- ENGL 823 Topics in American Literature Since 1865 3(3,0)** Significant authors; works in poetry and prose; literary-intellectual movements such as realism, naturalism, modernism, and postmodernism from 1865 to the present.
- ENGL 831 Special Topics 3(3,0)** Topics not covered in other courses.
- ENGL 832 Topics in Scientific, Technical, and Business Writing 3(3,0)** Seminar in areas such as professional editing and publishing, writing for government and industry, teaching technical writing, and writing for journals, magazines, and newspapers.
- ENGL 833 Rhetoric of Science 3(3,0)** Rhetorical approaches to understanding science and scientific rhetorics.
- ENGL 834 Usability Testing Methodologies in Professional Communication 3(3,0)** Research methodologies used in testing the usability of professional communication.
- ENGL 835 Topics in Literary Criticism 3(3,0)** Principal statements of literary critics from the classical era to the present.



**ENGL 836 Digital Publishing Technologies: Theories in Practice 3(3,0)** User-centered design theories applied to multimedia interfaces and on-line documents for professional communicators.

**ENGL 838 Global Professional Communication 3(3,0)** Implications of professional communication in a global economy; theories of global professional communication; research methods for studying communication in the global workplace; models for global communicative practices.

**ENGL 839 Writing Proposals and Grant Applications 3(3,0)** Practice in reading requests for proposals, analyzing rhetorical contexts and theories of proposals, and writing proposals and grant applications.

**ENGL (A A H, COMM) 840 Selected Topics 3(3,0)** Independent/directed study; tutorial work in linguistics or American, British, or European literature not offered in other courses. *Preq:* Consent of director of MA in English program.

**ENGL 850 Research and Studies in Scientific, Business, and Technical Writing 3(3,0)** Theories of professional communication and methods of inquiry; readings and research into the ways that the writing of professionals creates new knowledge and affects the daily life of others; research methods emphasize humanistic inquiry.

**ENGL 851 Seminar in Professional Writing 3(3,0)** Advanced seminar in the principles and practice of writing and editing documents for government, industry, and the sciences; students produce projects suitable for publication, typically chosen from document design, scientific or technical journalism, and public policy writing.

**ENGL 852 Rhetoric and Professional Communication 3(3,0)** Theories of communication that have existed since classical times and that inform effective decision-making strategies in professional communication.

**ENGL 853 Visual Communications 3(3,0)** Understanding the language of images used in textual and extratextual communication; theories of perception, methods of visual persuasion, gender analysis, and cognitive and aesthetic philosophies of visual rhetoric.

**ENGL 854 Teaching Professional Writing 3(3,0)** Teaching professional writing and examining theories and practices of written, graphic, and oral communication. Students prepare course descriptions, rationales, and syllabi for teaching various forms of business, scientific, and technical writing.

**ENGL 856 Theories and Practices of Workplace Communication 3(3,1)** Workplace cultures and their theoretical and practical applications for professional communication.

**ENGL 860 The Rhetoric of Web Publishing 3(3,0)** Seminar in the theory and practice of communicating on the World Wide Web. *Preq:* ENGL 853.

**ENGL 863 Advanced Empirical Research in Professional Communication 3(3,0)** Advanced empirical methods for the study of communication practices. Collection and analysis of qualitative and quantitative data. Study design and proposal writing.

**ENGL 865 Rhetoric and Communication Technologies 3(3,0)** Examination of communication technologies and practices used by professional communicators in business and industry environments. *Preq:* ENGL 852 or consent of instructor.

**ENGL 870 Professional Communication Pedagogy, Administration, and Assessment 3(3,0)** Theory and praxis of professional communication in academic instruction and selected methods of pedagogical and programmatic assessment. Throughout this seminar, emphasis is placed on communication across the curriculum, academic program administration, and the scholarship of teaching and learning.

**ENGL 871 Principles of Writing Assessment 3(3,0)** Focuses on a wide range of issues in writing assessment including an introduction to assessment theory, classroom issues such as grading and response, programmatic issues such as student placement and writing program assessment, and political and social contexts surrounding the highly-charged field of writing assessment.

**ENGL 872 Print and Digital Portfolios 3(3,0)** Focuses on theories, development, construction, and assessment of print and digital portfolios in educational contexts including the classroom, school reform, and other large-scale efforts, programmatic assessments, and personal/professional development. Special attention is given to ways the medium shapes reflection, presentation, connections, and artifacts within the portfolio.

**ENGL 873 Assessment of Digital Texts 3(3,0)** Writing assessment of texts integrating written, visual, audio, and digital media. Also considers implications of machine-read, -scored, and -generated texts on writing assessment.

**ENGL 874 Program Assessment 3(3,0)** Addresses practical and theoretical issues surrounding the administration and assessment of writing programs in secondary and post-secondary education. Special emphasis is given to the placement of college students into first-year writing courses and Writing Across the Curriculum program assessment.

**ENGL 875 Research Methods in Writing Assessment 3(3,0)** Presents a variety of qualitative and quantitative methods with direct applications to research in writing and program assessment. Includes constructing and implementing a multimodal research project on an assessment area.

**ENGL 876 Special Topics in Writing Assessment 3(3,0)** Selected readings from topics in writing assessment for focused study of relevant theories, research, and best practices. May be repeated for a maximum of six credits, but only if different topics are covered.

**ENGL 880 Applied Experience in Research and Communication 3-6(3-6,0)** Students apply their knowledge of professional communication concepts and research to develop and conduct a substantial professional communication project. Projects must include a research component and may also involve teaching or training, production of communication deliverables for clients, or other applications of communication skills. May be repeated for a maximum of six credits. *Preq:* A A H 864 and COMM 861, or consent of instructor.

**ENGL 885 Composition Theory 3(3,0)** Teaching college-level courses, stressing contemporary composition theory, research, and practice. Required of all MA in English and MAPC Teaching Assistants.

**ENGL 886 Composition Practicum 1(1,0)** Problems in teaching Composition I and Composition II, with focus on translating theoretical concepts into creating assignments, designing curriculum, and grading. Two-semester sequence to be taken fall and spring of teaching assistantship year. Does not count toward degree. *Preq:* Graduate teaching assistantship and ENGL 885 or equivalent.

**ENGL 887 Writing Center Theory and Practice 1(1,0)** Prepares graduate students in English and Professional Communication Programs to work with students in the Writing Center. *Preq:* Graduate standing or consent of instructor.

**ENGL 891 Master's Thesis Research 1-12**

**ENGL 892 Master's Project 1-3** Required for nonthesis option in MA in Professional Communication. Requires writing a document for the professional world and keeping a log or journal as a record of the project. Students present projects to advisor. A maximum of three credits may be counted toward the degree.

**ENGL 899 Doctoral Dissertation Research 1-18**

## ENTOMOLOGY

**ENT (BIOSC) 600 Insect Morphology 4(3,3)** Study of insect structure in relation to function and of the variation of form in insects. Offered fall semester of even-numbered years only. *Preq:* ENT 301.

**ENT 601 Insect Pests of Ornamental Plants and Shade Trees 3(2,3)** Recognition, biology, damage, and control of insect pests of woody and other ornamental plants and shade trees. Offered fall semester only. *Preq:* ENT 301.

**ENT 604 Urban Entomology 3(2,3)** Study of pests common to the urban environment with emphasis on biology, damage, control, and identification of household, structural, stored products, and food pests. Students learn both theoretical and practical aspects of urban pest management and the pest-control industry. Offered fall semester of even-numbered years only. *Preq:* ENT 301.

**ENT (PL PA) 606 Diseases and Insects of Turfgrasses 3(2,2)** See PL PA 606.

**ENT 607 Applied Agricultural Entomology 4(3,3)** Topics include recognition, biology, damage, and control of economically important insects and mites found on major Southeastern field, fruit, nut, and vegetable crops. Principles and practices of crop protection including pesticide application, economic basis for decision making, and development of scouting programs are introduced. Offered fall semester of even-numbered years only. *Preq:* ENT 301 or equivalent.

**ENT (BIOSC) 615 Insect Taxonomy 3(1,6)** Identification of the principal families of the major orders of adult insects. Laboratory work consists of intensive practice of such identification; lecture material deals with theoretical discussion of taxonomic features observed in the laboratory. Offered spring semester of odd-numbered years only. *Preq:* ENT (BIOSC) 400 or consent of instructor.



**ENT (BIOSC, ENTOX) 630 Toxicology 3(3,0)**  
See ENTOX 630.

**ENT (BIOSC) 636 Insect Behavior 3(2,3)** Fundamentals of insect behavior in an evolutionary and ecological perspective. Laboratory emphasizes generation and testing of hypotheses and observation, description, and quantification of insect behavior. Offered fall semester of odd-numbered years only. *Preq:* ENT 301 or consent of instructor.

**ENT (BIOSC) 655 Medical and Veterinary Entomology 3(2,3)** Insects and their arthropod relatives which are of economic importance in their effect on man and animals. Offered fall semester of odd-numbered years only. *Preq:* ENT 301 or consent of instructor.

**ENT 662 Seminar Presentation 1(1,0)** Advanced instruction and practice in delivering oral seminar presentations of scientific information. Emphasis is on preparing visual aids, organization, content, and practice in speaking to a specialized scientific audience.

**ENT (BIOSC, W F B) 669 Aquatic Insects 3(1,6)** Identification, life history, habitats, and interrelationships of aquatic insects; techniques of qualitative field collecting; important literature and research workers. Offered spring semester of odd-numbered years only. *Preq:* ENT 301 or consent of instructor.

**ENT (GEN) 695 Insect Biotechnology 3(3,0)** Considers many unique features exhibited by insects and describes applications of biotechnology to enhance useful products from insects and to affect the control of destructive insects. *Preq:* ENT 301, GEN 302.

**ENT 700 Entomology for Teachers 3(2,2)** General entomology course for secondary school science teachers with emphasis on collecting and identifying the more common insects; insect morphology, physiology, metamorphosis, and methods available for control of destructive species. Not open to Entomology majors pursuing the MS or PhD degrees. Offered spring semester only. *Preq:* Consent of instructor.

**ENT 808 Taxonomy of Immature Insects 3(1,6)** Identification of immature insects emphasizing the Holometabola. Identified collection is required. Offered fall semester of odd-numbered years only.

**ENT 809 Seminar in Entomology 1(1,0)** Current literature and research in entomology. Class attendance is mandatory. May be repeated for credit. To be taken Pass/Fail only.

**ENT 810 Selected Topics 1-4(1-4,0)** Current areas of entomological research and pest management. Course may be repeated for credit. *Preq:* Consent of instructor.

**ENT 840 Insect Ecology 3(2,3)** Principles of insect ecology, population dynamics, and natural regulating mechanisms of insect populations; effect of environment on distribution and abundance of insects. Offered spring semester of odd-numbered years only.

**ENT 843 Insect Pathology 3(2,3)** Insect diseases, their etiology, symptomatology, and epizootiology; infectious diseases caused by viruses, bacteria, fungi, and protozoa; ecological significance of these pathogens; their practical applications in medicine and agriculture. Offered fall semester of odd-numbered years only. *Preq:* ENT 301 or consent of the instructor.

**ENT 853 Applied Systematics 3(2,3)** Application of evolutionary principles to resolution of contemporary zoological problems; legal issues and technical skills for efficient operation of international zoological information storage and retrieval system. Offered spring semester of even-numbered years only. *Preq:* Taxonomic course in entomology or zoology or consent of instructor.

**ENT 860 Insect Pest Management 3(3,0)** Application of ecological principles to the management or control of insect populations; major factors influencing insect population fluctuations; integrated systems including biological, cultural, physical, chemical, and other techniques forming a unified multifaceted approach based on applied ecology. Offered spring semester of even-numbered years only.

**ENT 863 Special Problems in Entomology 1-3(0,3-9)** Entomological research not related to thesis. *Preq:* Consent of instructor.

**ENT 870 Insect Physiology and Molecular Biology 4(3,3)** Advanced instruction on the structure and function of insect physiological processes at the molecular, cellular, and tissue levels; physiological and molecular mechanisms underlying the various internal systems of insects. The laboratory emphasizes hands-on experimentation and the scientific writing technique to report experimental findings. *Preq:* BIOL 111, CH 223, ENT 301, 495, or consent of instructor.

**ENT 891 Master's Thesis Research 1-12**

**ENT 991 Doctoral Dissertation Research 1-12**

## ENVIRONMENTAL AND NATURAL RESOURCES

**E N R (BIOSC) 613 Restoration Ecology 3(3,0)** Applies ecological principles to the restoration of disturbed terrestrial, wetland, and aquatic ecosystems. Includes the restoration of soils and waterways, of flora and fauna, and of natural ecological processes such as plant succession and nutrient cycling. *Preq:* Introductory course in ecology or conservation biology, consent of instructor.

**E N R (FOR) 616 Forest Policy and Administration 2(2,0)** See FOR 616.

**E N R (FOR) 634 Geographic Information Systems for Landscape Planning 3(1,6)** See FOR 634.

**E N R 650 Conservation Issues 3(3,0)** Interactive study and discussion of issues related to the conservation of natural resources, emphasizing current issues in the conservation of biodiversity, identification of conflicting issues between consumptive and nonconsumptive resource management, and development of viable solutions for conservation of resources. *Preq:* W F B (BIOSC) 313 or consent of instructor.

## ENVIRONMENTAL DESIGN AND PLANNING

**EDP 801 Advanced Theory in Environmental Design and Planning 3(3,0)** Critical assessment of history and theory in the fields of design, planning, and construction. Topics include scientific knowledge, interpretive and critical inquiry, theories of urban form and human settlement. *Preq:* Master's-level course in theory related to design, planning, and construction.

**EDP 805 Readings in Architecture 3(3,0)** Historical and contemporary readings in architecture designed to provide exposure and depth of coverage for important works in the field. May be repeated for a maximum of six credits. *Preq:* EDP 801 and consent of instructor.

**EDP 806 Readings in Landscape Architecture 3(3,0)** Historical and contemporary readings in landscape architecture designed to provide exposure and depth of coverage for important works in the field. May be repeated for a maximum of six credits. *Preq:* EDP 801 and consent of instructor.

**EDP 807 Readings in City and Regional Planning 3(3,0)** Historical and contemporary readings in city and regional planning designed to provide exposure and depth of coverage for important works in the field. May be repeated for a maximum of six credits. *Preq:* EDP 801 and consent of instructor.

**EDP 809 Research Workshop in Environmental Design and Planning 3-6(1-2,6-12)** Students participate in an interdisciplinary, semester-long project to develop and apply a systematic approach to a real-world design and planning issue. A project report and presentation are prepared.

**EDP 810 Contemporary Issues in Environmental Design and Planning 3(3,0)** Interdisciplinary seminar providing an overview of theory and methods related to environmental design and planning. With that background, focus is on important contemporary and emerging issues affecting the built environment. *Preq:* PO ST (C R P) 870 or consent of instructor.

**EDP 812 Seminar in Environmental Design and Planning 1(1,0)** Weekly colloquium provides forum for faculty and student research and invited speakers to address important issues of the day. May be taken once for credit. *Preq:* EDP 815

**EDP 815 Research Design in Environmental Design and Planning 3(3,0)** Philosophy and method of scientific research. Within that context, students prepare a preliminary proposal for their dissertation research. *Preq:* EDP 801, EX ST 801, or equivalent.

**EDP 820 Instructional Design Delivery 1(1,0)** Presents information on teaching technique including discussions of cognitive learning, motivation, course organization, interactive lecturing, and experiential learning.



## ENVIRONMENTAL ENGINEERING AND SCIENCE

**EE&S 601 Environmental Engineering 3(3,0)** Introduction to the field of environmental engineering. Topics include environmental phenomena, impact of pollutants in the aquatic environment, solid-waste management, air pollution control, radiological health, and simple water and wastewater treatment systems. *Preq:* Junior standing in engineering or consent of instructor. *Coreq:* CE 341, CHE 311, ME 308 or consent of instructor.

**EE&S 602 Water and Waste Water Treatment Systems 3(3,0)** Study of fundamental principles, rational design considerations, and operational procedures of the unit operations and processes employed in water and waste water treatment. Both physiochemical and biological treatment techniques are discussed. Introduction to the integration of unit operations and processes into water and waste treatment systems. *Preq:* CE 341, CHE 311, ME 308, or consent of instructor.

**EE&S 610 Environmental Radiation Protection 3(3,0)** Fundamental principles of radiological health and radiation safety. Topics include radiation fundamentals, basic concepts of environmental radiation protection, internal and external dosimetry, environmental dose calculations, and radiation protection standards. Offered fall semester only. *Preq:* Consent of instructor.

**EE&S 611 Ionizing Radiation Detection and Measurement 3(2,3)** Laboratory exercises in ionizing radiation detection and measurements. Topics include nuclear electronics; counting statistics; radiation interactions; basic gas, scintillation, and semiconductor detectors; gamma-ray spectroscopy; health physics survey instrumentation; and thermoluminescent dosimetry. Offered spring semester only. *Preq:* EE&S 410 or consent of instructor.

**EE&S 630 Air Pollution Engineering 3(3,0)** Introductory course in air pollution and its control. Topics include air pollutants and effects, sources, dispersion models, engineering controls, and air-quality legislation. *Preq:* Senior standing in engineering or physical sciences.

**EE&S (B E, FOR) 651 Newman Seminar and Lecture Series in Natural Resources Engineering 1(0,2)** See BE 651.

**EE&S 680 Environmental Risk Assessment 3(3,0)** Quantitative estimation of the human health risk posed by the release of a contaminant to the environment. Topics include methods for analyzing emission rate, environmental transport, exposure, and health effects; methods of uncertainty analysis; and the role of risk assessment in environmental regulation and environmental decision making. *Preq:* EE&S 401 or consent of instructor.

**EE&S (B E, IE) 684 Municipal Solid Waste Management 3(3,0)** Introduction to the problems, regulations, collection, handling, recycling, and disposal of municipal solid wastes in the urban and rural sectors. Emphasis is on integrated waste-management systems with resource recovery, composting, incineration, landfill disposals, and their costs. *Preq:* Senior standing in engineering or science or consent of instructor.

**EE&S 685 Hazardous Waste Management 3(3,0)** Introduction to problems, regulations, treatment, and ultimate disposal of hazardous and toxic materials. Spill cleanup, groundwater transport, land disposal, incineration, and treatment technologies are discussed. Offered spring semester only. *Preq:* EN SP 200 or EE&S 401 or consent of instructor; two semesters of general chemistry.

**EE&S 686 Pollution Prevention and Industrial Ecology 3(3,0)** Topics include pollution prevention technology, the role of pollution prevention within a corporation, source reduction and recycling, pollution prevention assessments, treatment to reduce disposal, life-cycle assessment, design for environment, industrial ecology. Emphasis is on case studies. *Preq:* Senior standing in College of Engineering and Science.

**EE&S 690 Special Projects 1-3(1-3,0)** Studies or laboratory investigations on special topics in the environmental engineering and science field. Arranged on a project basis with a maximum of individual student effort and a minimum of staff guidance. May be repeated for a maximum of three credits. *Preq:* Consent of instructor.

**EE&S 701 Special Problems 1-6(1-6,0)** Environmental engineering problems selected to meet the interests and experience of students and instructor. Formal report is required. Restricted to MEng students. To be taken Pass/Fail only.

**EE&S 802 Environmental Engineering Principles 3(3,0)** Fundamental principles required for simulation and modeling of environmental engineering phenomena; mass transfer, reactor kinetics, simulation techniques, and applications to various natural and engineered systems. Offered fall semester only.

**EE&S 803 Physicochemical Operations in Water and Wastewater Treatment Systems 3(3,0)** Principles of physicochemical operations used in water and wastewater treatment including sedimentation, filtration, mixing, gas transfer, adsorption, ion exchange, coagulation, precipitation, disinfection, and oxidation. Offered spring semester only. *Preq:* EE&S 802, 843.

**EE&S 804 Biochemical Operations in Wastewater Treatment Systems 3(3,0)** Principles of biochemical operations used in wastewater treatment; modeling of ideal biochemical reactors and design criteria for aerated lagoons, activated sludge, trickling filters, rotating biological contactors, nitrification, denitrification, and digestion. Offered spring semester only. *Preq:* EE&S 802, 851.

**EE&S 805 Laboratory in Water and Wastewater Treatment Operations 3(0,6)** Laboratory exercises in selected water and wastewater treatment operations including sedimentation, filtration, adsorption, coagulation, softening, aeration, activated sludge, aerobic digestion, and anaerobic digestion. Offered spring semester only. *Coreq:* EE&S 803 or 804.

**EE&S 806 Process and Facility Design for Environmental Control Systems 2-4(2-4,0)** Integration of unit operations into complex systems for treatment of industrial/domestic water and wastewater, contaminated groundwater or air, landfill leachate, and toxic liquid wastes. Student teams design an integrated system for either water/wastewater or a hazardous/toxic waste. Offered fall semester only. *Preq:* EE&S 803, 804.

**EE&S (GEOL) 808 Groundwater Modeling 3(3,0)** See GEOL 808.

**EE&S (GEOL) 809 Subsurface Remediation Modeling 3(3,0)** See GEOL 809.

**EE&S (GEOL) 810 Analytical Methods for Hydrogeology 3(3,0)** See GEOL 810.

**EE&S 812 Environmental Nuclear Engineering 3(3,0)** Environmental aspects of nuclear technology emphasizing nuclear reactors and the nuclear fuel cycle; environmental transport of radioactive materials; radioactive effluents from nuclear power plants; nuclear power plant safety; environmental aspects of fuel cycle activities; waste management. Offered fall semester only. *Preq:* EE&S 610, consent of instructor.

**EE&S 813 Environmental Radiation Protection Laboratory 1(0,3)** Continuation of EE&S 611; advanced experiments in radiation detection, radiation protection, health physics, and environmental monitoring. Offered fall semester only. *Preq:* EE&S 611 and consent of instructor.

**EE&S (CH E) 814 Applied Numerical Methods in Process Simulation 3(3,0)** See CHE 814.

**EE&S 815 Actinide Chemistry 3(3,0)** Chemical and physical aspects of actinide metals and compounds (including properties, structure and bonding, reactions, kinetics, thermodynamics), coordination and solution chemistry, behavior and speciation in the environment, separation and purification, chemistry of the nuclear fuel cycle and waste treatment, and related topics; fundamental concepts, history, and recent developments. *Preq:* CH 402, MTHSC 208, PHYS 221, or consent of instructor.

**EE&S 832 Air Pollution Meteorology 3(3,0)** Applications of meteorology to air pollution; micrometeorology; plume rise modeling; atmospheric diffusion; deposition and washout of pollutants; air chemistry; applications of diffusion modeling to air quality planning. *Preq:* Consent of instructor.

**EE&S 833 Air Pollution Control Systems 3(3,0)** Principles and design of air pollution control equipment including mechanical collectors, electrostatic precipitators, baghouse filters, wet scrubbers, adsorbers, and incinerators. Offered spring semester only. *Preq:* EE&S 430 or consent of instructor.

**EE&S 834 Particles in the Atmosphere 3(3,0)** Chemical and physical behavior of atmospheric particles and their interaction with other particles, gases and light; generation, measurement methods, and control strategies of atmospheric particles. *Preq:* EE&S 630, MTHSC 208, or consent of instructor.



**EE&S 837 Biodegradation and Bioremediation** 3(3,0) Basic principles of biodegradation for major classes of organic contaminants including halogenated aliphatics and aromatics, fuel hydrocarbons, pesticides, and nitrated energetic compounds; biotransformations of metals; biodegradation principles applied to the development of bioremediation technologies including intrinsic, in situ, and on-site engineered approaches. *Preq:* EE&S 851.

**EE&S 843 Environmental Engineering Chemistry I** 3(3,0) Principles of chemical kinetics and thermodynamics applied to fundamental understanding of aqueous environmental samples including natural waters, wastewaters, and treated waters; factors controlling chemical concentrations, acid-base equilibria, solubility equilibria, complex formation, electrochemistry, adsorption phenomena. Offered fall semester only. *Preq:* CH 102 or equivalent.

**EE&S 844 Environmental Engineering Chemistry Laboratory I** 3(2,3) Laboratory experience in basic analytical methods used in water quality studies; experimental design, sampling, wet-chemical analytical techniques, data collection and analysis, data interpretation, and data quality techniques. Offered fall semester only. *Preq:* Two semesters of general chemistry.

**EE&S 845 Environmental Engineering Chemistry II** 3(3,0) Application of parameters that describe the equilibrium distribution and exchange rates for environmentally significant organic compounds to the modeling of processes in engineered and natural systems, including environmental parameter estimation techniques, structure-activity relationships, and integration of environmental processes to model contaminant distribution and residence time in environmental systems. Offered spring semester only. *Preq:* Two semesters of general chemistry, EE&S 843 or equivalent.

**EE&S 847 Advanced Environmental Chemistry** 3(3,0) Advanced principles and methods in environmental engineering chemistry with applications to both natural and treatment systems; current investigative and study techniques; nature, fluxes, and controlling processes of chemical species and radionuclides in environmental systems. *Preq:* EE&S 843 or equivalent.

**EE&S 849 Environmental Engineering Chemistry Laboratory II** 2(0,6) Theory and applications of instrumental methods of analysis as applied to measurements for environmental control; spectroscopy and spectrophotometric techniques; electrochemical analyses; chromatographic methods of analysis; light scattering and electrophoretic measurements. Offered fall semester only.

**EE&S 850 Stream and Estuarine Analysis** 3(3,0) Physical, chemical, and biological processes and relationships which exist in streams and estuaries; estuarine environment; free-flowing streams; mechanisms describing transport of conservative and nonconservative materials through estuarine systems; the estuary as a resource and techniques for its management. Offered fall semester only.

**EE&S 851 Biological Principles of Environmental Engineering** 3(3,0) Basic principles of biology and biochemistry as applied to problems of environmental control and wastewater treatment; kinetic and energetic aspects. Offered fall semester only.

**EE&S 852 Subsurface and Wetland Hydraulics** 3(3,0) Hydraulics of subsurface water including hydraulic head and gradient concepts, Darcy's Law, saturated/unsaturated flow, flow in aquifers and aquitards, flow to wells, and interactions with surface water in wetlands including discharge and development of seepage faces. Mathematics is at the level of elementary ordinary and partial differential equations. *Preq:* Differential equations, fluid mechanics or EE&S 802 or consent of instructor.

**EE&S 855 Surface and Subsurface Transport** 3(3,0) Quantitative analysis of reactive transport and biodegradation in ground water and surface water; applications of the advection-dispersion equation with reaction terms including classical chemical reactions, radioactive decay, and reactions mediated by microbes. *Preq:* C E 340 and MTHSC 208 or equivalent.

**EE&S 856 Pollution of the Aquatic Environment** 3(3,0) Effects of domestic and industrial water pollution on the physical, chemical, and biological characteristics of natural waters; associated environmental determinants of human disease, toxicology, and epidemiology of chronic disease. Offered fall semester only.

**EE&S 861 Environmental Engineering and Science Seminar** 1(1,0) Current advances and research developments in various areas of environmental engineering and science. Off-campus speakers, students, and faculty participate. To be taken Pass/Fail only.

**EE&S 880 Environmental Risk Assessment** 3(3,0) Methodology of quantitative risk assessment including identification and quantification of the source term, calculation of environmental transport, and estimation of health effects. Applications involve various classes of contaminants in atmospheric and aquatic environmental pathways. Offered spring semester only. *Preq:* MTHSC 208, graduate standing in engineering or science.

**EE&S 881 Special Problems 1-4** Problems selected to meet interests and experiences of student and instructor.

**EE&S 883 Selected Topics in Environmental Engineering 1-4(1-4,0)** Topics in environmental engineering not covered in other courses. Topics vary to keep pace with current developments. May be taken concurrently with EE&S 884, which (if offered) would be a different topic.

**EE&S 884 Selected Topics in Environmental Engineering 1-4(1-4,0)** Topics in environmental engineering not covered in other courses. Topics vary to keep pace with current developments. May be taken concurrently with EE&S 883, which (if offered) would be a different topic.

**EE&S 891 Master's Thesis Research** 1-12

**EE&S 961 Environmental Engineering and Science Doctoral Student Seminar** 1(1,0) Current advances and research developments in various areas of environmental engineering and science. Doctoral students are required to enroll each semester that the course is offered and present on seminar per year. To be taken Pass/Fail only.

**EE&S 991 Doctoral Dissertation Research** 1-12

## ENVIRONMENTAL SCIENCE AND POLICY

**EN SP 671 Man and His Environment** 2(2,0) The interaction of man with his environment is surveyed. Factors such as urbanization, population growth, pathogens, disease vectors, ionizing radiation, sewage disposal, and noise control are considered. Effects of environmental contacts with air, water, food, and solid and liquid wastes are emphasized. *Preq:* Consent of instructor.

**EN SP 672 Environmental Planning and Control** 2(2,0) Application of planning and control to effective environmental quality improvement. Water supply and treatment, wastewater treatment and disposal, solid waste disposal, air pollution abatement, and land use and zoning are considered from the standpoint of control. Not intended for graduate students in engineering. *Preq:* Consent of instructor.

## ENVIRONMENTAL TOXICOLOGY

**ENTOX 600 Wildlife Toxicology** 3(3,0) Assessment of impacts of toxic substances on reproduction, health, and well-being of wildlife species; acute and chronic effects of agricultural chemicals, pesticides, hazardous waste, industrial waste, and oil releases are discussed. *Preq:* BIOCH 305 or organic chemistry, one year of general biology, W F B 350 or consent of instructor.

**ENTOX 621 Chemical Sources and Fate in Environmental Systems** 3(3,0) Chemical cycles in the environment are discussed on global and microcosm scales. The dependence of fate processes on physical and chemical properties and environmental conditions is examined. Breakdown, movement, and transport of selected toxicants are addressed to illustrate the mechanisms that govern chemical fate. *Preq:* Organic and analytical chemistry or consent of instructor.

**ENTOX (BIOSC, ENT) 630 Toxicology** 3(3,0) Basic principles of toxicology including quantitation of toxicity, toxicokinetics, biochemical action of poisons, and environmental toxicology are studied. Acute and chronic effects of various classes of poisons are discussed (e.g., pesticides, drugs, metals, and industrial pollutants) in relation to typical routes of exposure and regulatory testing methods. Offered fall semester of odd-numbered years only. *Preq:* Organic chemistry, one year of general biology, or consent of instructor.

**ENTOX 637 Ecotoxicology** 3(3,0) Study of the effects of stressors on the ecosystem. Explores the integrative relationships that comprise the field of ecotoxicology in a hierarchical format that focuses on the various levels of ecological organization. *Preq:* ENTOX 430 or consent of instructor.



**ENTOX 801 Advanced Wildlife Toxicology 3(1,6)** Interactions between chemical contaminants and wildlife species focusing on effects at the organismal, species, trophic, community, and ecosystem level. Field and laboratory techniques that professional wildlife toxicologists use are emphasized. *Preq:* ENTOX 400, 430.

**ENTOX (BIOSC) 811 Immunotoxicology 3(3,0)** Study of how environmental contaminants, drugs, and natural biotoxins affect the immune system of man and animals; cellular and molecular mechanisms of action by immunotoxic agents. *Preq:* AVS 825, ENTOX 630, consent of instructor.

**ENTOX 822 Analytical Toxicology Laboratory 3(1,6)** Laboratory instrumentation, procedures, and experimental methods used for identification and quantitation of toxic substances and their transformation products in environmental and biological samples; application of these procedures in the isolation, detection, and quantitation of toxicants in authentic samples. *Preq:* Organic and analytical chemistry or consent of instructor; instrumental analysis recommended.

**ENTOX (ZOOL) 830 Mechanistic Toxicology 3(3,0)** Detailed biochemical toxicology: control, regulation, and activity of metabolic enzymes; molecular and cellular mechanisms of toxic action; proposed mechanisms for initiation and development of cancer; mode of action and kinetics of cholinesterase inhibitors; structure/activity relationships of ion channel blockers; biochemical and molecular biomarkers. *Preq:* ENTOX (BIOSC, ENT) 430.

**ENTOX (ZOOL) 831 Biomarkers in Toxicology 3(1,6)** Methodology used in biomarker identification and evaluation of the effects of toxic substances on living systems using biomarkers in sentinel organisms and surrogate biomarkers. *Preq:* Organic chemistry and biochemistry with laboratory; ENTOX 400 or (BIOSC, ENT) 430; or consent of instructor.

**ENTOX 841 Procedures and Techniques in Ecological Risk Assessment 2(1,3)** Evaluation and application of the procedures and techniques used in ecological risk assessments, including laboratory and field methods, to determine, measure, and evaluate the risks to aquatic, terrestrial, and avian species; impacts to biota within, and resulting from, chemical waste disposal facilities and hazardous waste sites. *Preq:* CH 223, 224, 313; EX ST 804 or 805; ENTOX (BIOSC, ENT) 630; or consent of instructor.

**ENTOX 852 Ecological Models 3(2,3)** Systems analysis applied to ecology; construction of models which predict ecological consequences of stresses to the environment; frequency response analysis, energy models, information flow, and transfer functions for population interactions. *Preq:* Course in ecology and in computer programming or consent of instructor.

**ENTOX (ZOOL) 854 Aquatic Toxicology 3(3,0)** Combines concepts of solution chemistry with toxicology to establish stressor-response relationships for aquatic organisms at various trophic levels. Bioavailability is a unifying concept, and concepts of contaminant exposure and organism response are set in an ecological risk assessment framework.

**ENTOX 855 Sediment Toxicology and Chemistry 3(3,0)** Focuses on the chemistry and toxicology of contaminants in freshwater sediments. Sediment geochemistry, ecology, toxicity bioassay methodology, and sediment sampling are discussed in a course framework that deals directly with contaminant bioavailability questions. *Preq:* ENTOX 854 or consent of instructor.

**ENTOX 860 Graduate Seminar 1(1,0)** Recent research in environmental toxicology; presentation, review, and discussion of current issues by graduate students in an area of specialization selected by the instructor. May be repeated four times for credit. To be taken Pass/Fail only.

**ENTOX 861 Departmental Seminar 1(1,0)** Presents current research by Department of Environmental Toxicology faculty, staff, finishing graduate students, and invited speakers. Improves students' skills in evaluation of research plans and oral presentations and increases their awareness of literature resources and employment opportunities in the field. May be repeated four times for credit.

**ENTOX 863 Selected Topics 1-4(0-4,0-6)** Topics in environmental toxicology not covered in other courses. Topics vary with current developments in the discipline. May be repeated, but only if different topics are covered. *Preq:* Consent of instructor.

**ENTOX 891 Master's Thesis Research 1-12**

**ENTOX 991 Doctoral Dissertation Research 1-12**

## EXECUTIVE LEADERSHIP AND ENTREPRENEURSHIP

**E L E 600 Technology Entrepreneurship 3(3,0)** Introduction to technology entrepreneurship with emphasis on ideation, opportunity assessment, market and technology forecasting, intellectual property protection, financial modeling and business valuation, project management, and cross-functional team building. Open to science and engineering majors only. *Preq:* Junior standing.

**E L E 800 Special Topics in Technology Entrepreneurship 1-6(1-6,0)** Comprehensive study of a topic of current interest in technology entrepreneurship. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* E L E 400.

## EXPERIMENTAL STATISTICS

**EX ST 611 Statistical Methods for Process Development and Control 3(3,0)** Experimental design techniques for use in process development, application of screening experiments and response surface experiments, techniques for process control with implications for product quality control. Includes discussions of the use of statistical computer analyses and interpretations including computer-generated graphics. *Preq:* MTHSC 206 or consent of instructor.

**EX ST 662 Statistics Applied to Economics 3(3,0)** Continuation of EX ST 301 with emphasis on statistical methods used in the collection, analysis, presentation, and interpretation of economic data. Special attention is given to time series analysis, construction of index numbers, and designing samples for surveys in the social science fields. Offered fall semester only. *Preq:* EX ST 301.

**EX ST 801 Statistical Methods I 4(3,3)** Role and application of statistics in research; estimation, test of significance, analysis of variance, multiple comparison techniques, basic designs, mean square expectations, variance components analysis, simple and multiple linear regression, and correlation, and nonparametric procedures. *Preq:* Consent of instructor.

**EX ST 802 Statistical Methods II 3(3,0)** Extended coverage of several methods introduced in EX ST 801: multiple regression model building and diagnostics, experiment design and analysis, and nonparametric methods; mixed models and repeated measures analyses; categorical data analysis; multivariate methods and sampling designs; appropriate use of statistical software. *Preq:* EX ST 801.

**EX ST 803 Regression and Least Squares Analysis 3(3,0)** Regression analysis: simple and multiple linear, curvilinear and multiple curvilinear; curve fitting; least squares and computer techniques for fitting of constants and analysis of planned experiments. Offered spring semester only. *Preq:* EX ST 801.

**EX ST 804 Sampling 3(3,0)** Principles of scientific sampling; finite population sampling; simple random, stratified, multistage, and systematic sampling; optimum allocation; methods of obtaining, processing, and reporting survey information; sampling as related to the environment, natural resources, and social and economic problems. *Preq:* EX ST 801.

**EX ST 805 Design and Analysis of Experiments 3(3,0)** Basic designs and analysis; data transformations; single degree of freedom, orthogonality and responses in ANOVA; covariance; response surfaces; incomplete blocks; introduction to least squares analysis of experiments; uses of standard computer programs for selected analyses. *Preq:* EX ST 801.

**EX ST 811 Special Problems in Experimental Statistics 1-3(0,2-6)** Statistical aspects of an individualized research problem; determining an appropriate experimental design; performing proper analyses and generating effective reports.

**EX ST 812 Selected Topics 1-3(1-3,0)** Topics in applied statistics not covered in other courses. May be repeated, but only if different topics are covered.

## FAMILY AND COMMUNITY STUDIES

**FCS 810 Life in the Global Community 3(3,0)** Examines global perspectives and trends related to social, psychological, and physical well being of children, youth, adults, families, primary institutions of society, and civil society. Considers accommodation and resistance to globalization as well as analysis and comparative review of the effects of globalization on everyday life in selected countries.



**FCS 811 Human Development and Family Life in Cultural Context 3(3,0)** Examines cultural context in human development and family life; the impacts of culture on physical, cognitive, and social development; the influences of different environmental experiences on individual and family functioning; practical applications of a cross-cultural human and family development perspective; and the state of human development around the world. *Preq:* FCS 810.

**FCS 812 Democracy and the Growth of Civil Society 3(3,0)** Study of democracy as a political system and a way of life. Examines the nature of civil society and its relation to the development and sustainability of democratic values and institutions and the cultural, economic, and political correlates of civic participation at various points in the lifespan. *Preq:* FCS 810 or consent of instructor.

**FCS 820 International Human Rights Law 3(3,0)** Examines international human rights law, the origins of international human rights, the emergence of international human rights law, issues related to the implementation, the position of the U.S. regarding ratification of human rights treaties, processes for monitoring and implementing human rights, and treatment of human rights in the courts.

**FCS 821 International Law and Policy on Children's Issues 3(3,0)** Comparative analysis of law and policy on children's issues. Attention is given to relevant international instruments, particularly the Convention on the Rights of the Child, and to related concepts in the law and policy of various nations, including the United States. *Preq:* FCS 820.

**FCS 822 Right to Health 3(3,0)** Examination of the relationship between health and human rights emphasizing the application of a rights-based approach to health-related interests of children, families, and communities. Topics include discussion of the content and contours of a right to health and of emerging trends in health and human rights. *Preq:* FCS 820 or consent of instructor.

**FCS 830 Community Development: Principles and Practices 3(3,0)** Comparative theory and practice of community development, community building, and community transformations that support child, youth, and family well-being. Includes U.S. community development examples with selected examples from other nations.

**FCS 831 Community Transformation 3(3,0)** Advanced course on community transformation theories, theologies, and practice. Discussion and illustrates major paradigm shifts within the last three decades in the way community development is thought about and done. Case studies on community transformation from selected nations are utilized. *Preq:* FCS 830 or consent of instructor.

**FCS 832 Policies and Programs in Human Services 3(3,0)** Philosophy, theories, and principles for organizing human services in and across selected nations, emphasizing strategies for and barriers to the development of collaborations among and between governmental and nongovernmental organizations. Discussion focuses on community-level child and family support, poverty alleviation, health care, early childhood education care, and old-age assistance. *Preq:* FCS 830 or consent of instructor.

**FCS 833 Humanitarian Assistance 3(3,0)** Introduction to humanitarian assistance. Topics include historical background, current status, determinants, legal issues, and health and social service delivery to current and past refugee and internally-displaced people, and ethno-political conflicts and terrorism as major sources of humanitarian crises. *Preq:* FCS 830 or consent of instructor.

**FCS 835 Religious Institutions in Community Life 3(3,0)** Focuses primarily on comparative review of religious organizations as core institutions in everyday life and community well-being; the personal, social, and political meaning of religious involvement; the theological frameworks motivating faith-based organizations' involvement in community development; the effects of globalization on normative religious behavior related to social action.

**FCS 840 Community, Societal, and International Research 3(3,0)** Covers issues and methods of community, societal, and international research and evaluation; macro-level assessment of the impact of interventions and the documentation of change; multi-method etic and emic strategies, theory-based evaluation, longitudinal designs, and collaborative, consultative models of research. *Preq:* PSYCH 810, 811; or consent of instructor.

**FCS 890 Research Project 1-6** Research in Family and Community Studies not related to a thesis.

**FCS 892 Special Topics 1-3(1-3,0)** Selected current and classic topics not covered in other courses. May be repeated for a maximum of 12 credits, but only if different topics are covered.

**FCS 893 Practicum 3** Comprehensive community building projects involving a group of Family and Community Studies majors working with a faculty member and community leaders. *Preq:* FCS 810, 820, 830, 840, or consent of instructor.

**FCS 896 Independent Study 1-6(1-6,0)** Individual readings or research on a topics selected according to the student's interests or professional development needs. May be repeated for a maximum of six credits. To be taken Pass/Fail only. *Preq:* Consent of coordinator of graduate studies.

**FCS 894 Internship 0** Students spend at least one academic year in residence at an affiliated center outside North America. Capstone learning experiences are done in connection with the internship experience, in part through distance learning. To be taken Pass/Fail only. *Preq:* FCS 810, 820, 830, 840, consent of graduate studies coordinator.

**FCS 991 Doctoral Research 1-18**

## FINANCE

**FIN 602 Advanced Corporate Finance 3(3,0)** Study of the decision process and analytical techniques used in evaluating corporate investment and making financial decisions. Topics include capital budgeting, real options, working capital management, mergers and acquisitions, bankruptcy and reorganization, and financial management in not-for-profit businesses. *Preq:* FIN 312 or consent of instructor.

**FIN 606 Analysis and Use of Derivatives 3(3,0)** Consideration of the option pricing theory and strategy techniques most commonly used in the market for options. An overview of the futures markets is also considered. Special emphasis is given to interest-rate futures, stock-index futures and foreign-exchange futures. *Preq:* FIN 305 or consent of instructor.

**FIN 615 Real Estate Investment 3(3,0)** Focuses on the structure and analysis of real estate investment emphasizing financial theory and analysis technique. Case study and project-oriented homework assignments facilitate the understanding of real estate investments. *Preq:* FIN 307 with a C or better or consent of instructor.

**FIN 616 Real Estate Valuation 3(3,0)** Advanced course in commercial real estate valuation. Topics include income capitalization, cash equivalency, highest and best use analysis, the cost approach, the direct sales comparison approach, and DCF analysis. *Preq:* FIN 307 with a C or better or consent of instructor.

**FIN 617 Real Estate Finance 3(3,0)** Advanced course applying financial analysis and theory to real estate. Mortgage credit analysis and current financing techniques for residential and commercial properties are emphasized. Topics include financial institutions, syndications, and construction financing. *Preq:* FIN 307 with a C or better or consent of instructor.

**FIN (M B A) 807 Financial Management 3(3,0)** See M B A 807.

**FIN (M B A) 812 Financial Markets and Institutions 3(3,0)** See M B A 812.

**FIN (M B A) 832 International Financial Management 3(3,0)** See M B A 832.

**FIN (M B A) 835 Investment Management 3(3,0)** See M B A 835.

**FIN (M B A) 836 Real Estate Principles 3(3,0)** See M B A 836.

**FIN 867 Advanced Financial Management 3(3,0)** Financial problem-solving skills developed through case analysis, class discussion, reading assignments, and a project. *Preq:* M B A (FIN) 807 or 857 or consent of instructor.

## FOOD SCIENCE

**FD SC 601 Food Chemistry I 4(3,3)** Basic composition, structure, and properties of food and the chemistry of changes occurring during processing utilization. Offered fall semester of even-numbered years only. *Preq:* BIOCH 305 or consent of instructor.

**FD SC 602 Food Chemistry II 4(3,3)** Application of theory and procedures for quantitative and qualitative analysis of food ingredients and food products. Methods for protein, moisture, lipid, carbohydrate, ash, fiber, rancidity, color, and vitamin analyses and tests for functional properties of ingredients are examined. Offered spring semester of odd-numbered years only. *Preq:* BIOCH 305 or consent of instructor.



**FD SC 604 Food Preservation and Processing 3(3,0)** Principles of food preservation applied to flow processes, ingredient functions, and the importance of composition and physical characteristics of foods related to their processing; product recalls and product development concepts. *Preq:* Physics and organic chemistry or biochemistry.

**FD SC 606 Food Preservation and Processing Laboratory 1(0,3)** Laboratory exercises on preservation methods, equipment utilized, and processes followed in food manufacture. *Coreq:* FD SC 404.

**FD SC 607 Quantity Food Production 2(1,3)** Principles of the production of food in quantity for use in food service systems, Emphasis is on functions of components of foods and of ingredients in food, on the quality of the final product, on safe production of food, and on proper use of equipment. *Coreq:* FD SC 306, 404.

**FD SC 608 Food Process Engineering 4(3,3)** Study of basic engineering principles and their application in food processing operations. The relation between engineering principles and fundamentals of food processing is emphasized. *Preq:* FD SC 214, CH 102, MTHSC 106, PHYS 207 or 200 or 122 or consent of instructor.

**FD SC 810 Chemical and Biochemical Aspects of Foods 4(4,0)** Chemical, biochemical, and functional properties of food components and their interactions in food emulsions, foams, colloids, and gel and solution states; the influences of processing on isolation, utilization, and production of the constituents using techniques based on constituent properties. *Preq:* BIOCH 623 and FD SC 401 or consent of instructor.

**FD SC 811 Physical and Thermophysical Properties of Foods 3(3,0)** Principles involved in relating physical and thermophysical properties to food quality. Includes standard methods and instruments to determine texture and the relationship of physical properties to sensory evaluation; interrelationships of chemical structure and physical properties in food processing operations. *Preq:* FD SC 810 or consent of instructor.

**FD SC 812 Microbiological Aspects of Food Systems 3(3,0)** Function and characteristics of microorganisms in the utilization and manufacture of food products; food fermentations, microbially induced chemical and physical changes, environmental aspects, and production of food ingredients and resources. *Preq:* MICRO 407 or equivalent or consent of instructor.

**FD SC 815 Food Service Systems Management 4(3,3)** Management of the procurement, production, distribution, and service of food that meets nutrition guidelines, cost parameters, and consumer acceptance criteria; supervision of customer satisfaction systems, marketing functions, and human resource systems.

**FD SC 820 Selected Topics in Food Science 1-3(1-3,0)** Special topics in food science not covered in other courses. May be repeated for a maximum of nine credits.

**FD SC 821 Selected Topics 1-4(0,3-12)** Independent research investigation in food science areas not conducted in other courses. May be repeated for a maximum of 12 credits. *Preq:* Consent of instructor.

**FD SC 851 Food Science Seminar 1(1,0)** Current research and related developments in food science reviewed by faculty, students, and invited lecturers.

**FD SC 852 Food Science Seminar 1(1,0)** Continuation of FD SC 851.

**FD SC 891 Master's Thesis Research 1-12**

## FOOD TECHNOLOGY

**FD TH 851 Food Technology Seminar 1(1,0)** Current and ongoing research and developments in food technology reviewed by faculty, students, and invited lecturers. *Preq:* Enrollment in the Food Technology PhD program or consent of instructor.

**FD TH 991 Doctoral Dissertation Research 1-12**

## FORESTRY

**FOR 600 Public Relations in Natural Resources 3(3,0)** Identifying relevant policies, their characteristics and acceptance to natural resource management, and techniques of maintaining appropriate public relations. *Preq:* Senior standing.

**FOR 613 Integrated Forest Pest Management 4(3,3)** Nature and control of pests of forest trees and products. Focuses on the relation of pests to silviculture, management, and natural forest ecosystems. Offered fall semester only. *Preq:* Junior standing in Forest Resource Management.

**FOR 615 Forest Wildlife Management 3(2,3)** Principles, practices, and problems of wildlife management with emphasis on upland forest game species. Habitat manipulation through use of appropriate silvicultural practices in association with other techniques is evaluated. *Preq:* FOR 460 or consent of instructor.

**FOR (E N R) 616 Forest Policy and Administration 2(2,0)** Introduction to development, principles, and legal provisions of forest policy in the United States and an examination of administrative and executive management in forestry.

**FOR 617 Forest Resource Management and Regulation 3(3,0)** Fundamental principles and analytical techniques in planning, management, and optimization of forest operations. *Preq:* FOR 302, 308, 418, 460.

**FOR 618 Forest Resource Valuation 3(3,0)** Analysis of capital investment tools and their application to decision making among forestry investment alternatives; valuation of land, timber, and other resources associated with forestry, including the impact of inflation and taxes. *Preq:* FOR 304 or consent of instructor.

**FOR 621 Biology and Silviculture of Hardwood Forests 2(1,2)** Study of the silvics, growth, and development of major hardwood species of North America that relates these biological characteristics to the ecology, silviculture, and utilization of the hardwood forests of the eastern United States. Offered fall semester only. *Preq:* FOR 460 or consent of instructor.

**FOR 623 Current Issues in Natural Resources 2(2,0)** Lectures in various fields of forestry delivered by selected representatives from forest industries, consultants, agencies, associations, and other forestry operations. Course will not be taught when enrollment is less than 15. To be taken Pass/Fail only. Offered fall semester only. *Preq:* Junior standing or consent of instructor.

**FOR (HORT) 627 Urban Tree Care 3(3,0)** Principles, practices, and problems of protecting and maintaining trees in urban and recreational areas. Examines environmental and biological factors affecting trees in high-use areas, their management and cultural requirements, and the practices necessary for their protection and care as valuable assets in the landscape. *Preq:* Junior standing or consent of instructor.

**FOR 631 Recreation Resource Planning in Forest Management 2(1,3)** Analysis of forest recreation as a component of multiple-use forest management; techniques of planning; physical and biological effects on forest environments; and forest site, user, and facility management. Offered spring semester of odd-numbered years only.

**FOR 633 GPS Applications 3(2,3)** Develops competence in global positioning system (GPS) technology including theory, methods, and application to natural resources mapping. Topics include basic concepts of GPS; projection systems; types of data; mission planning; and data capture, correction, and export to geographical information systems (GIS). *Preq:* Senior standing or consent of instructor.

**FOR (E N R) 634 Geographic Information Systems for Landscape Planning 3(2,3)** Develops competence in geographic information systems (GIS) technology and its application to various spatial analysis problems in landscape planning. Topics include data development and management, spatial analysis techniques, critical review of GIS applications, needs analysis and institutional context. GIS hardware and software, hands-on application. Credit may be received for only one of C R P 434, FOR (E N R) 434.

**FOR 641 Properties of Wood Products 3(3,0)** Basic properties of wood including the hygroscopic, thermal, electrical, mechanical, and chemical properties; standard testing procedures for wood. *Preq:* Junior standing or consent of instructor.

**FOR 642 Manufacture of Wood Products 3(3,0)** Manufacture of lumber, plywood, poles, piles; drying, preservation, grading, and uses of wood products. Manufacture of particleboard, flakeboard, oriented-strand board, fiberboard, and paper products. Includes physical, mechanical, and chemical properties and their applications. *Preq:* Consent of instructor.

**FOR 644 Forest Products Marketing and International Trade 3(3,0)** Study of marketing and international trade practices currently employed by the forest products industry and the application of basic marketing principles and global trade concepts in the industry's current and future environment. *Preq:* FOR 442 or consent of instructor.

**FOR 650 Woody Plant Stress Physiology 3(3,0)** Structure, function, and physiology of tree shoot and crown growth, wood formation, diameter growth, root growth, and reproduction especially as related to stress factors. *Preq:* BIOSC 401 or FOR 460 or consent of instructor.



**FOR (EE&S, B E) 651 Newman Seminar and Lecture Series in Natural Resources Engineering 1(0,2)** See B E 651.

**FOR 665 Silviculture 4(3,3)** Discussion of the theory and practice of manipulating forests to meet the needs and values of landowners and society in accordances with biological, ecological, and economic principles. *Preq:* FOR 206 and Forestry Summer Camp or consent of instructor.

**FOR 707 Special Problems in Forestry 1-3(1-3,0)** Directed individual study of a special problem in an applied field of forestry. Written report of study results is required.

**FOR 802 Advanced Mensuration 3(2,3)** Specialized sampling techniques and statistical methods often required only in forestry; compilation of timber volume tables; forest survey problems. Offered spring semester of even-numbered years only. *Preq:* EX ST 301 or consent of instructor.

**FOR 804 Advanced Forest Economics 3(2,3)** Examination, discussion, and application of economic principles to forestry problems in use of land, labor, and capital; use of theory in problems of resource allocation and efficiency in forest management. Offered fall semester of even-numbered years only. *Preq:* FOR 304 and 418 or consent of instructor.

**FOR 805 Forest Landscape Ecosystems 4(3,3)** Three basic landscape components of soils, landform, and vegetation; their interrelationships in forest ecosystems; factors and processes of soils as interacting components with landform and vegetation. Offered fall semester of even-numbered years only. *Preq:* Graduate standing or consent of instructor.

**FOR 806 Advanced Silviculture—Forest Tree Growth and Development 3(3,0)** Growth and development of economically important forest tree species; structure, function, phenology, and wood formation related under forest stand conditions emphasizing manipulation of forest tree growth by cultural practice; current research in growth and culture of forest trees and stands. Offered fall semester of odd-numbered years only. *Preq:* BIOSC 401, 402; or consent of instructor.

**FOR 807 Special Problems in Forestry 1-12** Special problems in forestry research methods that do not directly pertain to the candidate's thesis.

**FOR 808 Seminar 1(1,0)** Research and current developments in forestry. Students and staff participate. May be taken up to two semesters for credit. To be taken Pass/Fail only.

**FOR 809 Products Biodeterioration 2(1,3)** Role of microorganisms in reducing the strength, aesthetics, and value of products in service emphasizing the deterioration of wood. Offered fall semester of even-numbered years only.

**FOR 811 Forest Wetland Ecology and Management 2(2,0)** Assessment of ecological processes and how they influence forest wetland productivity, management, and regulation. Offered spring semester only. *Preq:* Introductory ecology or consent of instructor.

**FOR 812 Fire Ecology and Management 3(2,3)** Historical presence of fire in various regions of North America and its effects on forests; analysis of current fire management strategies with emphasis on usage of prescribed fire as an ecosystem management tool. *Preq:* Graduate standing or consent of instructor.

**FOR 814 Advanced Forest Resource Management and Planning 3(3,0)** Current forest resource management and planning topics; operational emphasis on application of various quantitative tools to solve economic and management problems; advanced topics in forest regulation, forest valuation, mathematical programming and harvest scheduling, simulation, multiple-use alternatives, and selected areas. Offered spring semester of odd-numbered years only. *Preq:* FOR 417 or consent of instructor.

**FOR 815 Systems Processes in Natural Resources 3(2,3)** Use of system thinking and system analysis to define the issues, model, simulate, and evaluate alternatives for forest landscape problems and opportunities.

**FOR (PRTM) 816 Remote Sensing and GIS in Natural Resources 3(2,3)** Practical application of computer mapping, spatial analysis, and natural resource inventory using remote sensing and geographical information systems. Offered spring semester of odd-numbered years only. *Preq:* FOR (E N R) 434 or consent of instructor.

**FOR 845 Biodiversity in Managed Forests 3(2,3)** Theory and practice of maintaining biodiversity are fundamental to successful management of forests. Conservation of biodiversity is viewed from the macro (landscape) and micro (stand) levels. Socioeconomic and policy as well as ecological perspectives are considered in design of appropriate management practices. *Preq:* FOR 415, 460, or consent of instructor.

**FOR 891 Master's Thesis Research 1-12**

**FOR 893 Selected Topics in Forest Resources 1-4(0-4,0-12)** Specialized topics not covered in other courses which explore current areas of research and management in forest and natural resources in a format of lecture, lab, or both. May be repeated for a maximum of eight credits, but only if different topics are covered. *Preq:* Graduate standing or consent of instructor.

**FOR 991 Doctoral Dissertation Research 1-12**

## FORESTRY AND NATURAL RESOURCES

**F N R 666 Stream Ecology 3(2,3)** Covers the ecology of flowing water systems. Topics include geomorphology, physical and chemical factors of streams, biology of stream-dwelling organisms, trophic relationships, competition, colonization, drift, community structure, disturbance, and human impacts. *Preq:* Junior standing or consent of department chair.

## FRENCH

**FR 151 French for Graduate Students 3(3,0)** Intensive program only for graduate students preparing for the reading examination in French. A minimum grade of B on final exam will satisfy Graduate School foreign language requirement. To be taken Pass/Fail only. May be repeated once for credit. *Preq:* Graduate standing.

**FR 699 Selected Topics in French Literature 3(3,0)** Selected topics that have characterized French literature, language, and culture. May be repeated for a maximum of six credits. *Preq:* Consent of department chair.

## GENETICS

**GEN (BIOSC) 605 Molecular Genetics of Eukaryotes 3(3,0)** Molecular genetic analyses of eukaryotes in relation to mutations and repair, complex phenotypes, biochemical pathways, short- and long-term regulation of gene expression, and evolution. *Preq:* GEN 302 or equivalent and one semester of biochemistry, or consent of instructor.

**GEN 610 Fundamentals of Genetics I 3(3,0)** First in a two-semester sequence in genetics covering Mendelian genetics, topics in cytogenetics, extranuclear inheritance, quantitative, evolutionary, conservation, and population genetics. *Preq:* CP SC 120 (or equivalent), EX ST 301, GEN 302, or consent of instructor.

**GEN (BIOSC) 616 Recombinant DNA 3(3,0)** Familiarizes students with the most current facts and concepts of molecular genetics. Lectures focus on gene organization, structure, and expression in prokaryotes and eukaryotes, highlighting current technologies and research in these areas. *Preq:* GEN 302 or equivalent and one semester of biochemistry or consent of instructor. A developmental biology course is also strongly recommended.

**GEN (BIOSC, MICRO) 618 Biotechnology I: Nucleic Acids Techniques 4(2,4)** Basic training in the manipulation of genetic information using recombinant DNA technology. Includes techniques in molecular cloning, Southern and Northern analyses, clone library construction. *Preq:* BIOCH 301 or 305, MICRO 305 or consent of instructor.

**GEN 620 Fundamentals of Genetics II 3(3,0)** Second in a two-semester sequence in genetics covering molecular genetics, gene expression, recombinant DNA technology, genomics, bioinformatics, proteomics, developmental, human, cancer, and behavioral genetics. *Preq:* GEN 410 or consent of instructor.

**GEN 640 Bioinformatics 3(3,0)** Theory and application of computational technology to analysis of the genome, transcriptome, and proteome. *Preq:* CP SC 120 (or equivalent), GEN 302, 410, or consent of instructor.

**GEN 650 Comparative Genetics 3(3,0)** Outlines the genome structure, function, and evolution based on available complete genome sequences. Topics include evolution of multigene families, origin of eukaryotic organelles, molecular phylogeny, gene duplication, domain shuffling, transposition, and horizontal gene transfer. *Preq:* GEN 420 and 440, or consent of instructor.



**GEN (BIOSC, HORT) 665 Plant Molecular Biology 3(3,0)** See HORT 665.

**GEN 670 Human Genetics 3(3,0)** Basic principles of inheritance; population, molecular, and biochemical genetics; cytogenetics; immunogenetics; complex traits; cancer genetics; treatment of genetic disorders; genetic screening and counseling; and the Human Genome Project. *Preq:* GEN 302 or consent of instructor.

**GEN (ENT) 695 Insect Biotechnology 3(3,0)** See ENT 695.

**GEN 730 Genetics Topics for Teachers 3(2,2)** Lectures and laboratories focus on genetics and biotechnology. Restricted to elementary and secondary teachers. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**GEN 801 Cytogenetics 3(2,3)** Classical and contemporary problems of chromosome structure, behavior, and transmission; recombination; interspecific hybridization; euchromatin and heterochromatin; polyploidy; mutable genetic systems; structural and numerical aberrations of chromosomes and their effects upon breeding systems of plants and animals. Offered spring semester of alternate years only. *Preq:* GEN 302 or equivalent.

**GEN 803 Quantitative Genetics 3(3,0)** Quantitative genetics concepts, line crosses and inbreeding, detecting major genes, mapping quantitative trait loci, estimation of genetic variation and heritability. Offered spring only. *Preq:* GEN 814 or consent of instructor. (EX ST 801 is recommended.)

**GEN (BIOCH) 805 Issues in Research 2(2,0)** See BIOCH 805.

**GEN 806 Special Problems in Genetics 1-3 (0,3-9)** Research not related to a thesis.

**GEN (BIOCH) 810 Methods in Molecular Biology 5(3,6)** See BIOCH 810.

**GEN 812 Physiological Genetics 3(3,0)** Advanced topics in the molecular aspects of physiological genetics including genes and metabolism, genes and signal transduction, oncogenes and growth, chromosomal aberrations, immunogenetics, and others. *Preq:* A semester of biochemistry and introductory genetics.

**GEN 814 Advanced Genetics 3(3,0)** Topics include organization of DNA in prokaryotes and eukaryotes, mutation, extranuclear inheritance, recombination, control of gene activity, systems of mating, genes and development, genetics of behavior, population genetics, genetics and disease. *Preq:* GEN 302 or equivalent, graduate enrollment in Genetics, or consent of instructor.

**GEN 815 Developmental Genetics 3(3,0)** Current research in developmental genetics including model systems, homeotic genes of *Drosophila*, primary induction, adhesion, molecules and cancer, axis formation, global pattern mutants in plants, homeobox genes in plants, and photo regulation. *Preq:* GEN 814 or consent of instructor.

**GEN (BIOCH) 820 Genomics and Proteomics 5(5,0)** Genomes, transcriptomes, and proteomes of a variety of organisms are studied along with the technology used to obtain them. Bioinformatics tools and access to this information are developed, and the significance of this information for the life sciences is made clear. *Preq:* BIOCH 814 or GEN 814 or consent of the instructor.

**GEN (BIOCH) 825 Seminar I 1(1,0)** Special topics and original research in genetics reviewed by students, faculty, and invited lecturers. May be repeated for credit. *Preq:* One semester of genetics.

**GEN 830 Population Genetics 3(3,0)** Topics include statistical methodology in the study of population genetics, probability as applied to genetic systems, gene and zygotic frequencies, derivation of genetics expectation, forces that change gene frequency, inbreeding, estimation, and testing of genetic parameters. *Preq:* GEN 814 or consent of instructor. (EX ST 801 is recommended.)

**GEN (BIOCH) 851 Seminar II 1(1,0)** See BIOCH 851.

**GEN 890 Special Topics in Genetics 1-3(1-3,0)** Group discussion of recent developments in genetic research. May be repeated for a maximum of six credit hours. *Preq:* GEN 302 and consent of instructor.

**GEN 891 Master's Thesis Research 1-12**

**GEN 991 Doctoral Dissertation Research 1-12**

## GEOGRAPHY

**GEOG 601 Studies in Geography 3(3,0)** Intensive study of the geography of a selected world regions, such as North America, Europe, or the Middle East or the geography of a topic, such as the geography of oil or the geography of underdevelopment. May be repeated once for credit with departmental consent. *Preq:* GEOG 101 or 103 or consent of instructor.

**GEOG 610 Geography of the American South 3(3,0)** Study of geography of the American South in its changing complexities of almost 400 years of development. *Preq:* GEOG 101 or 103 or consent of instructor.

**GEOG 620 Historical Geography of the United States 3(3,0)** Survey that places the spatial concepts of geography into a time sequence with emphasis on the United States. *Preq:* GEOG 101 or 103 or consent of instructor.

**GEOG (PRTM) 630 World Geography of Parks and Equivalent Reserves 3(3,0)** See PRTM 630.

**GEOG 640 Geography of Historic Preservation 3(3,0)** Aspects of historic preservation with emphasis on sites and structures in their geographical, historical, and socioeconomical contexts. Examples are drawn from American architectural styles and settlement forms. *Preq:* GEOG 101 or 103 or consent of instructor.

**GEOG 710 Teaching Geography 3(3,0)** Investigates world regions as a set of problems posed to teachers of geography; comparative analysis of basic geographic concepts. Oriented to public school teachers of geography.

## GEOLOGY

**GEOL 603 Invertebrate Paleontology 3(2,3)** Study of life of past geologic ages, as shown by fossilized remains of ancient animals, with emphasis on the invertebrates. *Preq:* GEOL 101 or consent of instructor.

**GEOL 605 Geomorphology 3(2,3)** Study of the surface features of the earth—their form, nature, origin, development, and rates and patterns of changes they are undergoing. Laboratory studies emphasize a process approach to terrain analysis stressing complex interactions of geologic, climatic, and tectonic forces. *Preq:* GEOL 101, 102, or consent of instructor.

**GEOL 608 Geohydrology 3(3,0)** Study of the hydrologic cycle, aquifer characteristics, theory of groundwater movement, mechanics of well flow, experimental methods, and subsurface mapping. *Preq:* GEOL 101, 102.

**GEOL 613 Stratigraphy 3(2,2)** Analysis of stratified rocks as the repository of earth history and the conceptual framework used to synthesize the world geologic record as a coherent whole. Emphasis is placed not only on traditional lithostratigraphy but also on modern seismic stratigraphy, biostratigraphy, magnetostratigraphy, and current stratigraphic issues. *Preq:* GEOL 314 or consent of instructor.

**GEOL 615 Analysis of Geological Processes 3(3,0)** Introduction to methods for analyzing geological processes. Mathematical methods are introduced to solve problems related to stream flow, reaction kinetics, radioactive decay, heat flow, diffusion, fluid flow through geologic media and related processes. *Coreq:* MTHSC 206 or consent of instructor.

**GEOL 621 GIS Applications in Geology 3(1,4)** Introduction to geographic information systems with applications to current geological and hydrological problems. Topics include use of global positioning systems, spatial analysis, and image analysis. Hands-on training with GIS software and techniques is covered. *Preq:* Senior standing, strong computer skills.

**GEOL 651 Selected Topics in Hydrogeology 1-4(1-3,0-3)** Selected topics in hydrogeology, with emphasis on new developments in the field. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* GEOL 300 or 408 or consent of instructor.

**GEOL 790 Selected Topics in Earth Sciences 1-6(0-6,0-18)** One or more earth science topics. Lecture and laboratory emphasize the incorporation of new or updated subject matter into classroom instruction. Restricted to elementary and secondary school teachers. May be repeated for credit, but only if different topics are covered.

**GEOL 800 Groundwater Geochemistry 3(2,3)** Lectures and project-oriented field work focusing on processes controlling natural impurities in groundwater and the occurrence of inorganic, organic, and radioactive contaminants; solution equilibria, chemical weathering, oxidation-reduction, utilization of radioactive isotopes as tracers and studies of contamination plumes. *Preq:* CH 102 or equivalent.



**GEOL 801 Field Geophysics Techniques and Interpretation 3(2,3)** Project-oriented field study of basic geophysical methods used for shallow geological investigations and for environmental site characterization; seismic, electrical, and electromagnetic sounding, ground-penetrating radar, magnetism, gravity, self-potentials, and borehole geophysics. Emphasis is on basic principles and physical understanding of the geophysical methods with applications in mind. *Preq:* Consent of instructor.

**GEOL 803 Geostatistics 3(3,0)** Numerical and statistical treatment of geological data emphasizing the analysis of spatially and temporally distributed variables and unique aspects of geological variables; methods of sampling geological data, quantitative procedures for reducing the dimensionality of geological data sets, and techniques for presentation and interpretation of results. *Preq:* EX ST 301 or MTHSC 301.

**GEOL 805 Advanced Stratigraphy 3(3,0)** Classification, distribution, chronologic succession, and correlation of sedimentary rocks; interpretation of features of strata in terms of their origin, depositional environment, paleogeography, and relation to organic evolution; Atlantic Coastal Plain stratigraphy. *Preq:* GEOL 413 or consent of instructor.

**GEOL 806 Aquifer Characterization 3(3,0)** Characterization of aquifers from the microscopic scale to the regional scale; geological origin of aquifers and modification by diagenetic and deformational processes; application of subsurface geological techniques to data acquisition and interpretation; prediction of fluid occurrence and flow by integrating results of subsurface analysis.

**GEOL 807 Tectonics 3(3,0)** Deformation processes and features of the Earth's crust at the regional to global scale; characteristic structures of active rift, transform and convergent margins; origin of mountain belts and sedimentary basins within a plate-tectonic framework. *Preq:* GEOL 302 or consent of instructor.

**GEOL (EE&S) 808 Groundwater Modeling 3(3,0)** Mathematical and computer modeling of groundwater flow and nonreactive solute transport through geological formations; conceptual flow-models for geologic systems; formulation of governing mass and energy conservation equations; application of analytical, numerical, and stochastic models to real-world problems. *Preq:* Consent of instructor.

**GEOL (EE&S) 809 Subsurface Remediation Modeling 3(3,0)** Lectures and computer exercises involving subsurface remediation methods including groundwater extraction, soil vapor extraction, stream flooding, and a variety of other techniques; modeling flow of multiphase and multicomponent mixtures in porous medium. *Preq:* GEOL (EE&S) 808 or consent of instructor.

**GEOL (EE&S) 810 Analytical Methods for Hydrogeology 3(3,0)** Analytical mathematical methods for modeling subsurface fluid flow and transport processes including saturated water flow, unsaturated zone gas flow, chemical transport, and heat transfer, emphasizing the derivation and solution of governing equations for modeling subsurface flow and transport. *Preq:* GEOL (EE&S) 808 or graduate-level groundwater course or consent of instructor.

**GEOL 811 Rock Physics 3(3,0)** Experimental and theoretical rock physics; electrical, fluid-transport and seismic properties; rock/solution interface and how that interface affects electrical, fluid transport, and seismic properties; magnetic, mechanical, and thermal responses. *Preq:* Consent of instructor.

**GEOL 813 Environmental Geochemistry 3(3,0)** Inorganic geochemistry, specifically the distribution of trace elements in rocks, regolith, and water. Topics include micronutrients and concepts of essentiality; health problems related to natural occurrence of toxic elements; environmental pollution arising from nonferrous metal mining, coal mining and coal use, and gasoline additives; urban and regional geochemistry. *Preq:* GEOL 318 or consent of instructor.

**GEOL 814 Environmental Sedimentology 3(3,0)** Environmental-based applications of sedimentology to developing an understanding of heterogeneity and scale, fluid flow and saturation, sediment-fluid interactions, and modeling approaches; field and laboratory methods; case studies; implications to environmental sustainability. *Preq:* Consent of instructor.

**GEOL 816 Aquifer Systems 3(3,0)** Hydrogeologic characteristics of selected major aquifer systems in the U.S. and elsewhere; conceptual models for the controls of recharge, discharge, and flow-through aquifers in different geologic settings; development of numeric models to simulate natural and stressed aquifers. *Preq:* GEOL 408 and (EE&S) 808 or consent of instructor.

**GEOL 818 Hydrogeology of Fractured Aquifers 3(3,0)** Processes and characteristics of fluid flow through naturally and artificially fractured subsurface formations; principles of flow in dual porosity materials, characterizing fractures and fractured aquifers, mechanics of fracture formation, methods of inducing fractures from wells; case studies and applications. *Preq:* GEOL 408 and (EE&S) 808 or consent of instructor.

**GEOL 850 Selected Topics in Environmental Geology 1-4(1-3,0-3)** Selected topics in environmental geology emphasizing the subsurface contamination. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**GEOL 851 Geology Seminar 1(1,0)** Students review current topics in geology and make oral presentations. May be taken twice for credit.

**GEOL 875 Hydrogeology Summer Field Camp 6(4,6)** Groundwater geology field techniques including examination of surface exposures, analysis of cores and geophysical well logs, subsurface mapping, aquifer performance test, and groundwater remediation. *Preq:* Consent of instructor.

**GEOL 891 Master's Thesis Research 1-12**

## GERMAN

**GER 151 German for Graduate Students 3(3,0)** Intensive program only for graduate students preparing for the reading examination in German. Minimum grade of B on final exam will satisfy Graduate School foreign language requirement. To be taken Pass/Fail only. May be repeated once for credit. *Preq:* Graduate standing.

**GER 698 Independent Study 1-3(1-3,0)** Selected topics in German literature, language, or culture. May be repeated for a maximum of six credits. *Preq:* Consent of department chair.

## GOVERNMENT AND INTERNATIONAL TRADE

**GINT 773 Personnel Administration 3(3,0)** Organization, techniques, and theories of personnel management; interpersonal relations in organizations; personnel change and development; changing conditions in the public service; educational specialization, unions, collective bargaining, etc.; ethics for public service.

**GINT 774 The Public Policy Process 3(3,0)** Public policy process including the role of public officials in the process and constraints on its outcomes.

## GRADUATE STUDIES

**G S 799 Comprehensive Studies 1-15(1-15,0)** Independent studies in preparation for comprehensive examinations; credit hours to be determined by the department or program chair. To be taken Pass/Fail only.

**G S 800 Research Proposal Development Seminar 1(1,0)** Principles and techniques for the preparation of research proposals. Does not count toward a graduate degree. To be taken Pass/Fail only. *Preq:* Second year or graduate standing in current major.

## GRAPHIC COMMUNICATIONS

**G C 605 Package and Specialty Printing 2(2,0)** Problems and processes for printing and converting in package, label, and specialty printing industries. Flexographic preparation, printing, die making, diecutting, transfer printing, screen container printing, pad printing, and bar code production are covered. New developments and trends are discussed. To be taken concurrently with G C 606. *Preq:* G C 245, 310, 350; or consent of instructor.

**G C 606 Package and Specialty Printing Laboratory 2(0,6)** Laboratory in techniques for printing and converting in package, label, and specialty printing industries. Experiences in flexographic prepress; printing; die design, die making, and diecutting for label, folding cartons, and corrugated; and glass, plastic, and metal container printing. *Preq:* G C 245, 310, 350 or consent of instructor; concurrent enrollment in G C 605.



**G C 607 Advanced Flexographic Methods 4(2,6)**

In-depth study of the methods used in flexographic printing and converting porous and non-porous substrates. Theory and laboratory applications include setting standards for process color, preparation of plate systems, ink mixing and color matching, testing of films and foils, analysis of recent developments, and prediction of future markets. *Preq:* G C 606 or consent of instructor.

**G C 640 Commercial Printing 5(2,9)**

Advances skills learned in previous graphic communications courses and applies the knowledge to large format presses. Students work from the design conception stage through all aspects of preparation, production, and finishing. Emphasis is on understanding and incorporating emerging technologies into the production workflow. *Preq:* G C 310 and 350 or consent of instructor.

**G C 644 Current Developments and Trends in Graphic Communications 4(2,6)**

Advanced course for Graphic Communications majors. Emphasis is on the theory and technical developments that affect process and equipment selection. Topics include color theory and application, electronic color scanning, electronic prepress and communications, gravure color quality control and analysis. *Preq:* G C 605, 606, 640.

**G C 645 Advanced Screen Printing Methods 3(2,3)**

Systems and materials used in the screen printing process emphasizing techniques of control and procedures for establishing screen printing methods and standards. *Preq:* G C 207 or consent of instructor.

**G C 646 Ink and Substrates 3(2,3)**

Covers components, manufacturing, process use, and end use of ink and substrates used in lithography, flexography, gravure, and screen printing. Examines the interrelationship among inks, substrates, and the printing process. Through controlled testing and examination, the optimum conditions for improved printability are determined. *Preq:* G C 605; 606 or 640; or consent of instructor.

**G C 648 Planning and Controlling Printing Functions 3(2,3)**

Study of systems for setting printing production standards, estimating, scheduling, job planning, and the selection of new hardware and technologies. *Preq:* G C 350, 450, 605, 606, 640, or consent of instructor.

**G C 690 Graphic Communications Selected Topics 1-3(1-3,0)**

Subjects not covered in other graphic communications courses; organized according to industry trends and student needs. May be repeated for a maximum of 18 credits, but only if different topics are covered. *Preq:* Consent of instructor.

**G C 801 Process Control in Color Reproduction 3(2,3)**

Techniques and rationale for procedures used in reproducing color originals for printed media. Topics include color systems, measurement, reproduction characteristics, proofing systems, process evaluation/analysis for offset, gravure, flexographic, and screen printing processes. *Preq:* G C 644 or equivalent.

**G C 811 Printing Industry Operations 3(2,3)**

Concepts and principles of operations and applications of technology and trends within the printing, publishing, packaging, and allied industries. Twelve plant visits supplement study of the organization, management, marketing, economics, production, environmental issues, and products of modern graphic communications firms.

**G C 831 Color Science Applied to Graphic Communications 3(2,3)**

Color reproduction applications found in both photomechanical and digital workflows for print production; foundation in color science principles, measurement, and integration relative to the printing, publishing, and packaging industry; color systems development, application, and integration. *Preq:* Consent of instructor.

**G C 850 Graphic Communications Internship 1(1,0)**

Full-time employment for hands-on experiences in manufacturing, marketing, or managing within the graphic communications industry. For Graphic Communications graduate students only. May be repeated for a maximum of two credits. *Preq:* G C 310 or equivalent and consent of instructor.

**G C 891 Master's Thesis Research 1-6(1-6,0)**

Student participation in a research project. Basic skills in a selected research methodology are developed. *Preq:* G C 894.

**G C 894 Graphic Communications Graduate Seminar 1(1,0)**

Discussions on relevant topics and guidance to prepare research proposals in the graphic communications field. May be repeated for a maximum of two credits, but only if different topics are covered. *Preq:* Graduate standing and consent of instructor.

**G C 897 Graphic Communications Research Problems I 3(3,0)**

In-depth investigation of phenomena relative to the printing, publishing, packaging, or allied industries. *Preq:* G C 894, acceptance of a written proposal, approval of advisor.

**G C 898 Graphic Communications Research Problems II 3(3,0)**

Continuation of G C 897. In-depth investigation of phenomena relative to the printing, publishing, packaging, or allied industries. *Preq:* G C 894, 897, acceptance of a written proposal, approval of advisor.

**HEALTH****HLTH 600 Selected Topics in Health 1-3(1-3,0)**

Topics selected to meet special and individualized interest of students in health. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Junior standing, consent of instructor.

**HLTH 601 Health Consumerism 3(3,0)**

Exploration of consumer decisions regarding health products and services with emphasis on strategies for decision making. Health majors and minors will be given enrollment priority. *Preq:* Two-semester sequence in science or consent of instructor.

**HLTH 610 Maternal and Child Health 3(3,0)**

Focuses on key issues concerning the health status and needs of mothers and children. Topics include primary health care, measurement and indicators of health status, health of minorities, role of families, and major programmatic interventions towards the health needs of these two groups.

**HLTH 611 Health Needs of High Risk Children 3(3,0)**

Analysis and evaluation of the health needs of high-risk families and special needs children from the prenatal period to age six. Emphasis is on health prevention and early intervention strategies. *Preq:* HLTH 410.

**HLTH 615 Public Health Issues in Obesity and Eating Disorders 3(3,0)**

In-depth review of prevalence, risk factors, consequences, and treatments of obesity and other eating disorders. Focuses on the public health importance of cultural norms, prevention, and early intervention as it relates to obesity and eating disorders. *Preq:* Junior standing in Health Science or consent of instructor.

**HLTH 620 Health Science Internship 1-6(0,3-18)**

Under supervision in an approved agency, students have an opportunity for on-the-job experiences. Students are placed in an agency and develop personal/professional goals and objectives appropriate to the setting, population, and health issues. Students create a comprehensive exit portfolio in a digital format. *Preq:* HLTH 419, minimum grade-point ratio of 2.0, Junior standing in Health Science, consent of instructor.

**HLTH 630 Health Promotion of the Aged 3(3,0)**

Focuses on analysis and evaluation of health issues and health problems of the aged. Emphasis is on concepts of positive health behaviors. Health majors and minors will be given enrollment priority. *Preq:* Developmental psychology; a two-semester sequence in science; or consent of instructor.

**HLTH 650 Applied Health Strategies 3(3,0)**

Students plan, implement, and evaluate strategies to promote health through individual behavior changes. Both healthful and unhealthful behaviors are included. Examples include smoking cessation, weight management, and stress management. *Preq:* HLTH 480, Health Science major.

**HLTH 698 Improving Population Health 3(3,0)**

Critical examination of current and emerging issues in improving public health practice and population health. Covers examples in empirical and applied research, revealing future trends in population health. Health majors and minors will be given enrollment priority. *Preq:* HLTH 240, 298, 380, or consent of instructor.

**HLTH (MICRO) 809 Epidemiological Research 3(3,0)**

See MICRO 809.

**HEALTH ADMINISTRATION****M H A 704 Health Policy 3(3,0)**

Provides students with a conceptual and analytical understanding of health policy-making and politics. Political and policy-making institutions and processes that affect the structure and functioning of the U.S. health care system are examined.

**M H A 705 Health Economics 3(3,0)**

Strengthens students' basic understanding of economics in general and helps develop an appreciation of the unique issues surrounding the health care sector in the United States. *Preq:* Undergraduate principles of economics.

**M H A 717 Selected Topics in Health Administration 1-3(1-3,0)**

Variable topics are taught to reflect current state-of-the-art issues. May be repeated for a maximum of six credits, but only if different topics are covered.



**M H A 719 Health Care Management 3(3,0)** Focuses on the structure and function of the well managed and appropriately led acute care hospital. Other health service organizations are also considered, and general management and operations theory are discussed.

**M H A 721 Health Care Delivery Systems 3(3,0)** Overview of the development of the health services delivery system in the United States.

**M H A 722 Health Behavior and Epidemiology 2(2,0)** Focuses on understanding the health behavior of a population and individuals. Introduces the concept of the health status of a population and discusses both methods of measurement and sources of data.

**M H A 724 Health Care Ethics 3(3,0)** Examination and analysis of the professional standards, laws, and political and economic forces that establish a context for health care ethics.

**M H A 729 Health Care Finance 3(3,0)** Introduces selected financial management topics including working capital management, capital budgeting, debt and equity instruments, and financial statement analysis.

**M H A 732 Outcomes Assessment and Evaluation in Health Services 3(3,0)** Introduces the general application of evaluative research in a variety of health care settings, administrative purposes of evaluation of organizational components and/or programs, and the design and implementation of evaluative efforts.

**M H A 735 Health Law and Risk Management 2(2,0)** Introduces legal concepts and issues related to health care management.

**M H A 741 Seminar in Community and Rural Health 3(3,0)** Introduces community health planning concepts and explores methods and the unique aspects of rural health among the population residing there.

**M H A 743 Managing with Health Professionals 3(3,0)** Devoted to learning about clinical professionals and exploring ways to facilitate effective and efficient team relationships in the management and delivery of health services.

**M H A 752 Health Administration Field Project 3(3,0)** Provides an opportunity to apply principles, theories, and concepts to a well-defined problem or issue currently confronting the health service administrator.

**M H A 853 Seminar in Health Administration and Leadership 2(2,0)** Integrates knowledge and skills acquired across all courses in the context of strategic management.

## HEALTH, EDUCATION, AND HUMAN DEVELOPMENT

**HEHD 800 Theories of Youth Development: An Applied Perspective 3(3,0)** Examines theories of positive youth development with an emphasis on how to apply them to "real world" issues facing young people. Students explore existing models, read theoretical and applied literature, and examine current social changes that impact positive youth development.

**HEHD 801 Child and Adolescent Development 3(3,0)** Focuses on child and adolescent development emphasizing a strength-based approach. Students develop an understanding of early childhood and adolescent growth and development from a social, cultural, and psychological perspective.

**HEHD 802 Youth Development Programming in a Contemporary Society 3(3,0)** Focuses on programs and administrative policies and procedures that govern youth development programs at the local, state, and national levels. Model programs emphasizing "best practices" are studied. A cross-sectional approach is used to examine assets and protective factors in the contexts of family, school, and community.

**HEHD 803 Creative and Ethical Leadership in a Changing Society 3(3,0)** Focuses on the development of leadership skills and group dynamics in program development and supervision of staff and volunteers. Students engage in listening, empowerment, and process skills utilizing the latest approaches in the field of communications. Professional ethics related to human service professionals are integrated.

**HEHD 804 Assessment and Evaluation of Youth Programs 3(3,0)** Focuses on developing knowledge of rationale, procedures, and tools for conducting intake, needs, and environmental assessments of youth, families, and communities. Effective skills for mastering comprehensive program evaluation strategies are taught. Students explore statistical packages specifically appropriate for evaluation of youth programs.

**HEHD 805 Youth Development in the Context of Family 3(3,0)** Focuses on youth development in the context of family development and interpersonal relationships. Students gain knowledge and skills in development issues and family functioning. Students become aware of and respect diverse family structures, parental involvement, and the influence of culture and ethnicity on family dynamics.

**HEHD 806 Youth Development in the Context of a Global and Diverse Society 3(3,0)** Focuses on specific circumstances and issues related to youth in at-risk environments. Students learn methods, strategies, and techniques to address diversity issues (i.e. racial, ethnic, gender, disability, sexual preference). Issues of poverty, mass culture, physical environment, etc. are examined globally.

**HEHD 807 Internship in Youth Development 3(0,9)** Practical experience in youth-serving agencies/organizations. Students are required to complete a minimum of 150 hours of experiential education in a supervised setting. Upon approval, exceptions are given to students with experience working in youth-related fields. To be taken Pass/Fail only. *Preq:* Consent of program coordinator.

**HEHD 808 Grantsmanship 3(3,0)** Students conduct searches to identify youth-related funding sources. They write proposals to include purpose, rationale, background information, literature review, identification of collaborators/partners, budget, budget justification, and human subjects review. *Preq:* Admission into the MS in Youth Development Program.

**HEHD 892 Master's Project 3(0,9)** Students conduct evaluative research projects to include writing an article for submission to a professional journal. Students present articles to instructor for review. To be taken Pass/Fail only. *Preq:* Consent of program coordinator.

## HISTORIC PRESERVATION

**H P 610 History and Theory of Historic Preservation 3(3,0)** Survey history of preservation that explores a variety of theoretical issues that impact the discipline. Provides a basis for critical evaluation of historic preservation. *Preq:* Three semesters of Art and Architectural History or equivalent or consent of instructor.

**H P 611 Research and Documentation in Historic Preservation 3(3,0)** Introduction to documenting and recording historic buildings and landscapes. Charleston and its environs provide case study projects for archival research, field investigation, and preparation of final documentation. *Preq:* Three semesters of Art and Architectural History or equivalent or consent of instructor.

**H P 612 Materials and Methods of Historic Construction 3(3,0)** Survey of traditional materials and methods of construction in America from the 18<sup>th</sup> through the early 20<sup>th</sup> century. Scientific examination of historic construction provides case studies. *Preq:* Three semesters of Art and Architectural History or equivalent or consent of instructor.

**H P 800 Historic Preservation Internship 1-3(1-6, 3-18)** Six credits of approved internship in Historic Preservation are required during the course of the graduate program and can be completed in one summer of the program. May be repeated for a maximum of six credits. To be taken Pass/Fail only. *Preq:* Consent of supervising faculty.

**H P 801 Legal and Economic Issues in Historic Preservation 3(3,0)** Examines historic preservation against the backdrop of contemporary legal and economic issues. *Preq:* ARCH 405, H P 410, 411, 412; or consent of instructor.

**H P 802 Historic Preservation Research Seminar 3(3,0)** Advanced documentation and analysis of historic resources in preparation for thesis project. *Preq:* H P 801, 805.

**H P 803 Advanced Materials and Methods in Conservation 3(3,0)** Advanced study of historic building materials and conservation techniques. *Preq:* H P 805. *Coreq:* H P 810.

**H P 804 Management and Administration of Historic Preservation 3(3,0)** Praxis on the management of historic properties with emphasis on administering a preservation project in the field and establishing a maintenance program for a historic property. *Preq:* H P 810.

**H P 805 Preservation Studio 6(0,18)** Examines Charleston and its environs through the development of a comprehensive preservation project for a specific site. *Preq:* ARCH 405, H P 410, 411, 412. *Coreq:* H P 801.

**H P 810 Conservation Lab in Historic Preservation 6(0,18)** Conservation of historic materials on site and in the lab. *Preq:* H P 805. *Coreq:* H P 803.



**H P 891 Thesis Research 1-6** Thesis proposals are defended in the third semester and completed as a multi-media project in the fourth semester of the program. Projects using the historic resources of Charleston and its environs, or other suitable historic sites, are encouraged. To be taken Pass/Fail only. *Preq:* H P 802, 810.

## HISTORY

**HIST 600 Studies in United States History 3(3,0)** Topics and problems in the history of the United States from the Colonial era to the present.

**HIST 620 History and Film 3(2,3)** Analyzes the role of the cinema in the construction and dissemination of history.

**HIST 624 Topics in History of Medicine and Health 3(3,0)** Selected topics in the development of medicine and health care including public attitudes towards health and medicine.

**HIST 628 A Famous American Trial in History 3(3,0)** Study of the social, cultural, and legal context of a famous American trial. Consideration is given to the actual trial record (transcripts, briefs, and opinions on appeal) and to historical studies of the time and place in which the trial arose. Trial selected varies. *Preq:* HIST 328 or 329 or consent of instructor.

**HIST 636 The Vietnam Wars 3(3,0)** Wars in Vietnam are seen in two phases. The First Indochina War, 1946–54, is covered briefly. Main body of the course covers the Second Indochina War, which began as a guerrilla conflict in 1959–60 and ended as a mostly conventional war in the Communist victory of 1975.

**HIST 638 Problems in African Historiography and Methodology 3(3,0)** Concentrates on major issues in the field of African history with an additional focus on methodological concerns.

**HIST 640 Studies in Latin American History 3(3,0)** Consideration of selected and varied topics in Latin American history through readings, class discussions, and individual or group projects. Special attention will be given to the use of an inquiry or problem-solving method of historical analysis and to the cultivation of a comparative perspective.

**HIST 650 Studies in Ancient History 3(3,0)** Selected topics in ancient history ranging from pre-Biblical times to the fall of the Roman Empire.

**HIST 651 Alexander the Great 3(3,0)** Focuses on the career of Alexander the Great and deals with the history and archaeology of ancient Macedonia.

**HIST 660 Studies in British History 3(3,0)** Examination of selected themes, topics, or periods in British history from Anglo-Saxon times to the present.

**HIST 670 Studies in Early European History 3(3,0)** Studies of selected topics or themes in European history from the fall of the Roman Empire to the age of industrialization.

**HIST 671 Studies in Modern European History 3(3,0)** Study of selected topics or problems in European history from the end of the Old Regime to the present.

**HIST 691 Studies in the History of Science and Technology 3(3,0)** Selected topics in the development of science and technology, with emphasis on their social, political, and economic effects.

**HIST 692 Studies in Diplomatic History 3(3,0)** Selected topics and problems in international conflict and conflict resolution among nations. Concentration is usually on 20<sup>th</sup> century history.

**HIST 693 Studies in Social History 3(3,0)** Studies in the ways people have earned their livings and lived their lives, individually and as communities, in the confines of different societies.

**HIST 694 Studies in Comparative History 3(3,0)** Selected topics in comparative history, contrasting and comparing similar historic developments in different nations, geographic areas, or civilizations.

**HIST 695 Studies in the History of Ideas 3(3,0)** Selected topics and themes in the development of ideas that have had an impact on the behavior of individuals and civilizations.

**HIST 696 Studies in Legal History 3(3,0)** Selected problems in the development of law and the system of criminal and civil justice.

**HIST 710 United States Since 1865 3(3,0)** Problems in U.S. history since 1865 with attention given to bibliography and teaching methods. Primarily for Master of Education candidates, but open to all graduate students. May be repeated with consent of graduate program director.

**HIST 775 Europe Since the 18<sup>th</sup> Century 3(3,0)** Problems in European history since 1700 with attention given to bibliography and teaching methods. Primarily for Master of Education candidates, but open to all graduate students. May be repeated with consent of graduate program director.

**HIST 800 Seminar in United States History 3(3,0)** Training in historical research and writing. May be repeated for credit with consent of graduate program director.

**HIST 810 Culture and Society 3(3,0)** Training in historical research and writing with a focus on the social and cultural underpinnings of U.S. history. May be repeated for credit as topics change with consent of graduate program director.

**HIST 820 American Historiography 3(3,0)** Graduate seminar designed to familiarize students with the major overarching themes, scholarly interpretations, and issues of American history that historians have presented over the last century.

**HIST 830 Seminar in Asian History 3(3,0)** Training in historical research and writing with focus on Asian history. May be repeated for credit with consent of graduate program director.

**HIST 840 Seminar in Latin American History 3(3,0)** Training in historical research and writing with focus on Latin American history. May be repeated for credit with consent of graduate program director.

**HIST 860 Seminar in British History 3(3,0)** Training in historical research and writing with focus on British history. May be repeated for credit with consent of graduate program director.

**HIST 870 Seminar in European History 3(3,0)** Training in historical research and writing with focus on European history. May be repeated for credit with consent of graduate program director.

**HIST 872 Issues and Methods in European and Non-Western History 3(3,0)** Seminar discussion of contemporary approaches to European and non-Western history; exploration of theoretical and empirical debates.

**HIST 880 Special Topics in History 3(3,0)** Training in historical research and writing. May be repeated for credit with consent of graduate program director.

**HIST 881 Historiography 3(3,0)** Seminar discussion of contemporary approaches and methodologies used by historians; exploration of current debates over major issues confronting the discipline of history.

**HIST 885 Independent Study 3(3,0)** Critical study of a historical topic, selected according to needs of student and with approval of graduate program director. May be repeated for credit with consent of graduate program director.

**HIST 887 Archival Management: An Introduction 3(3,0)** Introduction to basic concepts of archival theory and management.

**HIST 891 Master's Thesis Research 1-12**

**HIST 893 Practicum in Archival Management 3(0,9)** Hands-on experience in the operations of an archival program, including acquisitions, arrangements, descriptions, conservation, and reference service. *Preq:* HIST 887 or consent of instructor.

**HIST 894 Practicum in Historical Editing 3(3,0)** Practicum for applying methodologies learned in introductory editing course to a specific body of original sources such as family correspondence, diaries, or journals in order to become a historical editor.

## HORTICULTURE

**HORT 606 Nursery Technology 3(2,3)** Principles and techniques in handling nursery crops. Offered spring semester only. *Preq:* HORT 303, 305.

**HORT 612 Advanced Turfgrass Management 3(2,3)** Advanced principles and practices associated with turfgrass management for golf courses, sports fields, sod production, and commercial lawn care. Topics include turfgrass physiology, plant growth and development, construction, turfgrass nutrition, irrigation, drainage, pesticide use and fate, and development of effective management systems. *Preq:* CSENV 202, HORT 212, or consent of instructor.

**HORT 620 Applied Turfgrass Physiology 2(2,0)** Advanced course in turfgrass science and management. Provides the current status and development of turfgrass stress physiology and research. Main topics include temperature, drought, traffic, edaphic stresses, new developments in the turf industry, and environmental stewardship. *Preq:* HORT 212, 213.

**HORT (FOR) 627 Urban Tree Care 3(3,0)** See FOR 627.



**HORT (CSENV) 633 Integrated Weed Management for Agronomic and Horticultural Crops 3(2,2)** Weed management systems consisting of cultural, chemical, and biological methods for the major agronomic and horticultural crops of South Carolina with problem-solving methodology and herbicide injury diagnosis. Offered spring semester only. *Preq:* CSENV 407 or equivalent introductory weed science.

**HORT 655 Small Fruit Crops 3(2,3)** In-depth survey of taxonomical, morphological, and physiological characteristics of small fruit crops as they relate to the study of horticultural characteristics, culture, production, harvesting, and handling of both commercial and home-grown grapes, blueberries, strawberries, brambles, and kiwifruit. Offered fall semester only. *Preq:* HORT 101 or consent of instructor.

**HORT 656 Vegetable Crops 3(3,0)** Principles and practices employed in the commercial growing and marketing of vegetable crops with emphasis on plant characteristics, cultivars, management practices, harvest, quality factors and grading, storage, economic importance, and areas of production.

**HORT 661 Problems in Landscape Design 4(3,3)** Landscape planning for larger residential properties, schools, industrial plants, real estate developments; detailed finished plans; further study of materials used; original problems; field study. Offered spring semester only. *Preq:* HORT 308 or consent of instructor.

**HORT (BIOSC, GEN) 665 Plant Molecular Biology 3(3,0)** Study of fundamental plant processes at both the cellular and molecular levels including genome structure and organization (both nuclear and organellar); regulation of gene expression and its role in cellular and whole-plant processes; transposable genetic elements; applications for biotechnology. *Preq:* Junior standing or consent of instructor, BIOSC 304 or 305; GEN 302.

**HORT 671 Advanced Internship 1-6(0,2-12)** Preplanned work experience under competent supervision in approved agency dealing with horticultural endeavors. Gives advanced students on-the-job learning opportunities to apply acquired knowledge and skills. Monthly reports and final departmental seminar required. Undergraduates may accumulate a maximum of six credits for participation in HORT 271 and/or 471. *Preq:* Junior standing and consent of instructor.

**HORT 672 Garden Experiences in Youth Development 2(1,3)** Exploration of the role of gardening and related outdoor experiences in enhancement of educational development, self-esteem, and pro-social behavior in elementary school children. *Preq:* Senior standing and consent of instructor.

**HORT 701 Horticulture: Plant and Environmental Science 3(2,3)** Scope of South Carolina horticulture and how it affects the quality of life economically and aesthetically; environmental responsibilities; methods of teaching plant principles. Three-day statewide field trip to horticultural industries is included. Not to be taken for credit by graduate students in Horticulture. Offered summer session only.

**HORT 800 Topics in Horticultural Science 1(1,0)** Covers timely topics in horticultural science. May be repeated for a maximum of four credits, but only if different topics are covered. *Preq:* Consent of instructor.

**HORT 806 Postharvest Physiology and Handling of Horticultural Crops 3(3,0)** Principles, developments, and research findings dealing with physiological and biochemical changes and processes occurring in horticultural plant organs after harvest; biological aspects of methods and practices relating to harvesting, handling, transportation, and storage of horticultural commodities for fresh market. Offered spring semester of even-numbered years only. *Preq:* BIOSC 401 and 402 or equivalent.

**HORT 812 Special Problems in Horticulture 1-4(1-4,0)** Research not related to a thesis. May be repeated for a maximum of four credits. *Preq:* Consent of instructor.

**HORT 814 Environmental Plant Stress Physiology 3(2,2)** Environmental stresses associated with water (drought, waterlogging), temperature, light, and air pollution with quantitative treatment of stress effects on plants; mechanisms by which plants may avoid, tolerate, or modify stress effects on plant growth and function at the molecular, cellular, and whole-plant levels. Offered fall semester only. *Preq:* BIOSC 401 and 402 or consent of instructor.

**HORT (BOT) 851 Plant Anatomy 3(2,3)** See BOT 851.

**HORT (BOT) 861 Plant Cell Biology 3(3,0)** See BOT 861.

**HORT (BOT) 921 Plant Physiology Colloquium 1(1,0)** See BOT 921.

## HUMAN RESOURCE DEVELOPMENT

**H R D 830 Concepts of Human Resource Development 3(3,0)** Theory and practice of contemporary applications of human resource development (HRD) programs; training and development functions; strategies for designing and developing programs; and application of methods, techniques, and resources in the context of changing needs, technologies, demographics, and economic circumstances that create the need for different skills and knowledge in the work force. *Preq:* Consent of instructor.

**H R D (CTE) 845 Needs Assessment for Education and Industry 3(3,0)** Theory and practice of needs assessment activities in human resource development (HRD) programs; importance of the process to the identification of content/curricula topics and the overall training environment; specific methodologies used in the needs assessment process; supportive components of various program planning systems. *Preq:* H R D 830 or consent of instructor.

**H R D (CTE) 846 Applied Public Relations 3(3,0)** Practical and theoretical approaches to problem identification and the development of respective solutions in the public relations process; action and message generation, media development and evaluation of public relations techniques in existing organizations. *Preq:* Employment or ready access to an employer and place of employment; THRD 468 or 668 is desirable.

**H R D (CTE) 847 Instructional Systems Design 3(3,0)** Theory and practice of instructional systems development activities in human resource development (HRD) programs; identification, selection, and organization of subject matter appropriate for competency-based training (CBT) programs; occupational analysis techniques; rationale statements, goals, and objectives; related instructional materials; participant evaluation; and instructional scheduling. *Preq:* H R D (CTE) 845 or consent of instructor.

**H R D 849 Evaluation of Training and Development/HRD Programs 3(3,0)** Theory and practice of evaluation processes related to training and development in human resource development programs; developing a results-oriented approach based on specific criteria or standards; designing instruments; determining program costs; and collecting, analyzing, and interpreting data to ascertain return on investment. *Preq:* AG ED (CTE, ED) 889, H R D (CTE) 847, (CTE) 860 or consent of instructor.

**H R D (CTE) 860 Instructional Materials Development 3(3,0)** Development and application of instructional materials and laboratory activities for training programs in education and industry; reinforcement of instructional training concepts and materials development procedures that are applied across human resource development (HRD) programs. *Preq:* H R D (CTE) 845.

**H R D (CTE) 870 Consulting for Education and Industry 3(3,0)** Theory and practice of external and internal consulting practices in human resource development programs; dynamics of a professional helping relationship; methods and techniques for initiating and terminating consulting relationships; diagnosing client situations; identification, selection, and implementation of alternative problem solutions; evaluation of professional consulting relationships. *Preq:* H R D 830 or consent of instructor.

**H R D 897 Applied Research and Development 3(3,0)** Study of a particular topic under the direction of a faculty member. Students identify a special problem related to the human resource development profession based on their personal interests, experiences, needs, and goals. *Preq:* Submission of a written proposal, prior approval of advisor, satisfactory completion of 12 hours of graduate H R D courses, AG ED (CTE, ED) 889.

## HUMANITIES

**HUM (ENGL) 656 Literature and Arts of the Holocaust 3(3,0)** See ENGL 656.

## HYDROGEOLOGY

See courses listed under Geology.



## INDUSTRIAL ENGINEERING

**I E 640 Decision Support Systems in Industrial Engineering 4(3,2)** Design of decision support systems for production and service systems based on operations research models. Use of spreadsheets, databases, and integrated software development environments to implement decision support systems. *Preq:* I E 280; CP SC 161 or I E 220.

**I E 652 Reliability Engineering 3(3,0)** Probabilistic approach to assessing system reliability. Methods for analyzing serial, parallel, and complex systems. Reliability life testing and its acceleration are covered. Essential elements of maintainability are identified and related to system availability. *Preq:* I E 360.

**I E 656 Supply Chain Design and Control 3(3,0)** Industrial engineering aspects of supply chains including design and control of material and information systems. *Preq:* I E 386.

**I E 660 Quality Improvement Methods 3(3,0)** Study of modern quality improvement techniques presented in an integrated, comprehensive context. *Preq:* Senior standing.

**I E 661 Quality Engineering 3(3,0)** Design aspects of quality and the engineer's role in problems of quality in production systems. *Preq:* I E 360.

**I E 665 Facilities Planning and Design 3(3,0)** Study of the principles and techniques of plant layout. Economic selection of materials handling equipment and integration of this equipment into the layout plan to provide effective product flow. Quantitative techniques for evaluation of facilities plans. A design project is required. *Preq:* I E 280.

**I E 682 Systems Modeling 4(4,0)** Modeling of discrete industrial systems using a digital computer. The purpose, theory, and techniques of system modeling are presented. *Preq:* I E 381.

**I E (B E, EE&S) 684 Municipal Solid Waste Management 3(3,0)** See EE&S 684.

**I E 685 Industrial Systems Engineering 3(3,0)** Modeling and analysis of multistage decision processes, recursive optimization, process and system design, and control problems. *Preq:* I E 280, 381.

**I E 687 Industrial Safety 3(3,0)** Recognition and prevention of hazards; recognition and control of hazardous materials; developing and managing a safety program; designing inherently safe equipment and workplaces. *Preq:* Junior standing.

**I E 689 Industrial Ergonomics and Automation 3(2,3)** Physical ergonomics and ergonomics in industrial settings including work physiology, the physical environment, automated systems, and hybrid work systems. *Preq:* I E 210.

**I E 691 Selected Topics in Industrial Engineering 1-3(0-3,0-9)** Comprehensive study of any timely or special topic in industrial engineering not included in other courses. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.

**I E 800 Human Factors Engineering 3(3,0)** Fundamentals of design for human use; human performance; applications of abilities, and limitations to the design of tools, machines, facilities, tasks, and environments for efficient, safe, and comfortable human use. *Preq:* Consent of instructor.

**I E 801 Design and Analysis of Human-Machine Systems 3(3,0)** Methodologies used in the design and evaluation of human-machine systems including function and task analysis; questionnaires and interviews; scenarios, mock-ups, and prototypes; participative design, empirical testing, and iterative design; models of human-system interaction; analysis and classification of human error; and design of job performance and training aids. *Preq:* Graduate standing and consent of instructor.

**I E 802 Design of Human-Computer Systems 3(3,0)** Issues in designing, implementing, maintaining, and refining the user interface of interactive computer systems including interface design theories, models, principles, and guidelines; interaction styles; input and output devices; system messages; screen design, manuals, on-line help, and tutorials; and iterative design, testing, and evaluation. *Preq:* I E 801 or consent of instructor.

**I E 803 Engineering Optimization and Applications 3(3,0)** Introduction to optimization through the study of problems related to the planning, design, and control of production/manufacturing systems; classical nonlinear optimization and algorithmic procedures, primal and dual problems with postoptimality analysis, Markov chains. *Preq:* Graduate standing and consent of instructor.

**I E 804 Manufacturing Systems Planning and Design 3(3,0)** Concepts and principles associated with the design of manufacturing systems with a focus on modeling and integration methodologies; group technology, process planning, manufacturing modeling, and design for manufacturing. *Preq:* Graduate standing and consent of instructor.

**I E 805 Foundations in Quality Engineering 3(3,0)** Fundamental tools of quality engineering and their application to real situations; advanced statistical process control, design of experiments, Taguchi techniques, and Shainin methodologies. *Preq:* Graduate standing and consent of instructor.

**I E 807 Discrete Systems Simulation 3(3,0)** Constructing computer models to represent existing real-world systems or hypothetical future systems; experimenting with these models to explain system behavior, improve system performance, or design new systems with desirable performances. *Preq:* MTHSC 302 and I E 809 or consent of instructor.

**I E 809 Model Systems Under Risk 3(3,0)** Application of probabilistic methods to engineering problem solving and decision making. Cases are presented illustrating use of Markov chains, queuing processes, and other stochastic models in practice. *Preq:* MTHSC 302 or consent of instructor.

**I E 811 Human Factors in Quality Control 3(3,0)** Aspects of use of the human as a detector of product quality, serving as the basis for a taxonomy of human tasks in inspection; incorporates models of visual search and human decision making within the quality control framework. *Preq:* Graduate standing and consent of instructor.

**I E 812 Work Science and Design 3(3,0)** Design methods for work and work systems; scientific and engineering basis of work and its analysis. *Preq:* Consent of instructor.

**I E 813 Occupational Ergonomics 3(3,0)** Theory and applications of ergonomics at work; human performance, fatigue, stress, work patterns, work environment.

**I E 815 Research Methods in Ergonomics 3(2,2)** Contexts and processes for research in ergonomics with emphasis on engineering problems; scientific and engineering methods; measurement; visual and physical tasks; simulation, laboratory and archival studies. *Preq:* MTHSC 884 or equivalent or consent of instructor.

**I E 860 Dynamic Programming 3(3,0)** Theory and methodology of dynamic programming; Bellman's principle of optimality; Mitten's sufficiency conditions; recursive optimization of serial and nonserial multistage systems; optimization of discrete and continuous systems through decomposition; special aspects of problem formulation. *Preq:* I E 803.

**I E 865 Facility Planning and Design 3(3,0)** Planning and design of industrial facilities emphasizing automated production facilities; quantitative approaches to equipment design and evaluation of performance. *Preq:* I E 803.

**I E 871 Industrial Testing and Quality 3(3,0)** Design and use of component and product tests; automated inspection; test and inspection in integrated systems; cost-based models. *Preq:* I E 661.

**I E 880 Advanced Methods of Operations Research 3(3,0)** Methods and applications of advanced operations research techniques; discrete optimization, integer, and mixed integer programming, Boolean minimization, network optimization, permutization methods on implicit enumeration. *Preq:* I E 803 or consent of instructor.

**I E 884 Advanced Engineering Economic Analysis 3(3,0)** Engineering economic analysis for engineering research, development, and construction projects emphasizing detailed treatment of tax effects, methods for determining discount rates, proper use of economic criteria in various decision environments (certainty vs. uncertainty, single vs. multiple project selections, etc.). *Preq:* Consent of instructor.

**I E 886 Operations Research in Production Control 3(3,0)** Latest techniques in scientific inventory management, scheduling, and forecasting; operations research; statistics; computer methods; case studies. *Preq:* I E 803.

**I E 888 Advanced Probabilistic Methods 3(3,0)** Advanced treatment of stochastic optimization, potentially including single and multiple channel queues, Markov programming, and stochastic optimal control. *Preq:* Consent of instructor.

**I E 890 Special Problems in Industrial Engineering 1-3(1-3,0)** Principles and methods of industrial engineering applied to analysis of a current interest problem. May be repeated for a maximum of six credits. To be taken Pass/Fail only. *Preq:* Consent of instructor.

**I E 891 Master's Thesis Research 1-12**

**I E 892 Master's Design Project 3(1,6)** Design project in industrial systems; integration of industrial engineering principles and methodologies; resolution of contemporary systems design problems. Project requires research, development, implementation planning, reporting, and project assessment. *Preq:* Consent of instructor.



**I E 893 Selected Topics in Industrial Engineering 1-3(1-3,0)** Selected topics in industrial engineering emphasizing new developments in systems science, systems analysis, and operations research. May be repeated for credit. *Preq:* Consent of instructor.

**I E 895 Industrial Engineering Research Techniques 1(1,0)** Series of weekly one-hour lectures given by students, faculty, and guests on methods and issues involved in industrial engineering research. To be taken Pass/Fail only.

**I E 971 Advanced Quality Engineering Seminar 3(3,0)** Current topics in the research and development of quality engineering methodologies. *Preq:* I E 871 or consent of instructor.

**I E 991 Doctoral Dissertation Research 1-12**

## INTEGRATED PEST MANAGEMENT

**I P M 601 Principles of Integrated Pest Management 3(3,0)** Origins, theory, and practice of integrated pest management. Relationships among crop production and protection practices are explored. Economics of various control strategies are considered. Integrated pest management field projects are studied. Conventional and integrated pest management approaches are compared. Multidisciplinary plant problem analysis is introduced. *Preq:* CSENV 407, ENT 301, PL PA 310, or consent of instructor.

**I P M 700 Internship in Plant Health 1-5** Professional employment under competent supervision in an approved agency or organization dealing with the vocational or occupational aspects of plant health. During the internship, students submit weekly reports covering the experience. A terminal report is also required. To be taken Pass/Fail only. *Preq:* Second semester graduate standing, I P M 601, consent of instructor.

**I P M 704 Seminar 1(1,0)** Students and faculty review current research and development topics in integrated pest management. At least one presentation is required. May be repeated for a maximum of two credits. *Preq:* Consent of instructor.

**I P M 800 Special Problems in Plant Health 1-3(0,3-9)** Directed individual study of a special problem in plant health. Emphasis is on organizing, conducting, and reporting on independent investigation. *Preq:* Consent of instructor.

## LANDSCAPE ARCHITECTURE

**LARCH 605 Urban Genesis and Form 3(2,2)** Exploration of urban forms and developments within their historic context through off-campus, on-site lectures and exposure to historic cities and sites. Students visit historic and contemporary cities and analyze those places through readings and direct observations. Offered Maymester only. *Preq:* LARCH 252 or consent of instructor.

**LARCH 623 Environmental Issues in Landscape Architecture 3(3,0)** Overview of environmental and ecological issues and their relationship to landscape architecture practice and design. *Preq:* LARCH 452 or consent of instructor.

**LARCH 633 Historic Preservation in Landscape Architecture 3(3,0)** Study of historic landscape preservation in a number of contexts including gardens, vernacular landscapes, parks, cemeteries, and battlefields. *Preq:* LARCH 452 or consent of instructor.

**LARCH 643 Community Issues in Landscape Architecture 3(3,0)** In-depth study of issues relevant to community design. Overview of physical design and related social issues. *Preq:* LARCH 452 or consent of instructor.

**LARCH 653 Key Issues in Landscape Architecture 3(3,0)** Overview of research in landscape architecture and study of relevant research methods. Students write proposals for their own projects positioned within the larger context of research in the profession. *Preq:* Fifth-year Landscape Architecture student or graduate student, or consent of instructor.

**LARCH 801 Landscape Architecture Orientation I 6(3,9)** Focused study of design, design theory, and design communication. Assigned readings, lectures, and discussions link those topics to graduate-level explorations of design intervention in the cultural and natural landscape. *Preq:* Students in First Professional MLA program or consent of instructor.

**LARCH 802 Landscape Architecture Orientation II 6(3,9)** Second-semester course of focused study in design, design theory, and design communication. Assigned readings, lectures, and discussions link those explorations to graduate-level study in nature, culture, and design. Explorations begun in LARCH 801 are taken to greater depth and complexity. *Preq:* Students in First Professional MLA program or consent of instructor.

**LARCH 813 Advanced Regional Design 6(3,9)** Advanced study and analysis of natural and cultural landscapes at the regional scale with an emphasis on South Carolina. Exploration of landscape ecology as an informant to design and application geographic information systems. Each student also engages in independent research. *Preq:* Students in Second Professional MLA or MARCH program or consent of instructor.

**LARCH 823 Advanced Community Design Studio 6(3,9)** Studio focused on the study of communities. Students engage in a series of design explorations culminating in a mixed-use parcel on a large tract. Includes intensive study of growth and change in the contemporary landscape. New development in southeastern U.S. serves as a laboratory. *Preq:* LARCH 653 or consent of instructor.

**LARCH 830 Graduate Seminar I 3(3,0)** Seminar including reading, writing, and discussion on environmental and social/cultural issues in landscape architecture. Course is grounded in an exploration of the history of landscape architectural theory. *Preq:* LARCH 802 or consent of instructor.

**LARCH 840 Graduate Seminar II 3(3,0)** Graduate seminar in one of the areas of departmental focus: growth and change, health and design, or restoration. *Preq:* LARCH 830 or consent of instructor.

**LARCH 843 Interdisciplinary Design and Research 6(3,9)** Students participate in an interdisciplinary project linked to one of the focus areas in the department: health and design, restoration (environmental or cultural/historical), growth and change. Each student identifies a personal research project related to the larger team project. *Preq:* LARCH 653 or consent of instructor.

**LARCH 850 Graduate Colloquium 3(3,0)** Series of lectures and presentations by graduating students, faculty members, and guest designers and scholars. Students offer reviews and critiques of the various presentations. *Preq:* LARCH 840 or consent of instructor.

**LARCH 853 Advanced Interdisciplinary Design and Research 6(3,9)** Continuation of LARCH 843 with an advanced interdisciplinary project linked to one of the focus areas in the department: health and design, restoration (environmental or cultural/historical), and growth and change. Each student identifies a personal research project related to the larger team project. *Preq:* LARCH 843 or consent of instructor.

**LARCH 890 Directed Studies 1-6(1-6,0)** Special topics and independent research in landscape architecture with faculty guidance. May be repeated for a maximum of six credits. *Preq:* Consent of advisor.

**LARCH 891 Thesis Project 6(1,15)** Complex and sophisticated independent project in landscape architectural research and/or advanced design. *Preq:* LARCH 843 or consent of instructor.

## LANGUAGE

**LANG 600 Phonetics 3(3,0)** Study of basic phonetic concepts used in the study of sounds and language.

## LAW

**LAW 605 Construction Law 3(3,0)** Provides a practical knowledge of legal principles applied to the construction process and legal problems likely to be encountered by the practicing construction professional. Topics include construction contracting, liability, claims and warranties, documentation, and responsibility and authority of contracting parties. *Preq:* LAW 312 or 322 or consent of instructor.

**LAW 620 International Business Law 3(3,0)** Intensive examination of the historical background of modern public and private international law; selected issues of public international law—human rights, law of war, United Nations system, and international litigation; selected issues of private international law—international sales, international trade, and formation and operation of multinational businesses. *Preq:* LAW 312 or 322 or consent of instructor.

**LAW 801 Law for Professional Accountants 3(3,0)** Preparation for professional exams and responsibilities in managerial positions. Topics include professional and legal responsibilities of accountants, business organizations, commercial law, government regulation of business and property. Case studies, problems, and student papers are utilized. *Preq:* LAW 322 or equivalent.



**LAW 848 Law for Real Estate Professionals 3(3,0)** Provides the real estate professional with the fundamentals of law as it applies in the real estate arena. Explores the various legal forms of ownership, the form and process of real estate transactions, and governmental regulation of land use. *Preq:* Graduate standing or consent of instructor.

## M B A

See courses listed under Business Administration.

## MANAGEMENT

**MGT 803 Operations Management 3(3,0)** Introduction to a broad range of operations management topics. Serves as a foundation for understanding the importance, relevance, and significance of analytical models and tools to be introduced in subsequent courses in the MS in Management program. Topics include operations strategy, process and facility design, planning and control, quality management, and continuous improvement. Offered fall semester only.

**MGT 804 Operations Strategy 3(3,0)** In-depth study, through case studies and readings, of the role operations systems capabilities play in providing sources of competitive advantage. Topics include industry analysis, technological forecasting, formulation of organization and operations strategies, and development of operations system capabilities. *Preq:* MGT 803 or consent of instructor. Offered fall semester only.

**MGT 806 Industrial Management Internship 0** Faculty-approved internship to give MS in Management students on-the-job learning in support of classroom education. Internships must be at least six, full-time, consecutive weeks with the same internship provider. May be repeated. *Preq:* Consent of graduate coordinator.

**MGT 807 Comparative Management Theory 3(3,0)** Evolution of management theory, up to and including contemporary theories; comprehensive review of the major schools of management thought, with emphasis on the area of organization theory and design.

**MGT 808 Manufacturing Planning and Control Systems 3(3,0)** Important components of a manufacturing planning and control system emphasizing the integration of planning and control functions in a dynamic manufacturing environment; extensive hands-on work with integrated manufacturing software. Offered spring semester only. *Preq:* MGT 803 or consent of instructor.

**MGT (M B A) 809 Organizational Behavior and Human Resources Management 3(3,0)** Theories and models of behavior; human resources management concepts and processes as they apply to managing individual and work-group behavior in organizations. Organizational behavior topics include leadership, motivation, and teamwork. Human resource management topics include human resources strategy, selection, performance evaluation, reward systems, and employee development.

**MGT 812 Supply Chain Management 3(3,0)** In-depth study, through case studies and readings, of methodologies for designing and managing integrated, international supply chain networks. Topics include supply network design, distribution strategy, strategic alliances, inventory management, coordinated product and network design, and information systems for supply chain. Offered fall semester only. *Preq:* Consent of instructor.

**MGT 815 Personnel Management 3(3,0)** Personnel management activities including recruitment, selection, training and development, performance appraisal, discipline, grievance handling, wage and salary administration, and employee benefit programs.

**MGT 818 E-Commerce Web Site Development 3(2,1)** Enabling information technologies for electronic commerce, including databases and Web applications. These technologies are applied to a project. *Preq:* Computer programming experience.

**MGT 819 Web-Based Information Systems for Supply Chain Management 3(2,1)** Examines system architectures, technologies, approaches, and infrastructure requirements for supply-chain information systems. Students learn to design, develop, and implement systems that facilitate collaboration of an enterprise with its buyers and suppliers. *Preq:* MGT 812 and 818 or consent of instructor.

**MGT 820 Service Operations Management 3(3,0)** Concepts and techniques of service operating system design and management. Topics include characteristics of services, service system performance measurement, queuing and automation, planning and control in different service environments, and international service operations. *Preq:* MGT 803 or consent of instructor.

**MGT 821 Process and Facility Design 3(3,0)** Design of operating systems emphasizing the implications of technology and automation. Topics include technological core competencies, technological forecasting, process design, capacity planning, facility location and layout, and product and process development processes. Offered spring semester only. *Preq:* MGT 803 or consent of instructor.

**MGT 822 International Operations Management 3(3,0)** Operations management within an international business environment. Topics include the regulatory and cultural environment of international business, international business and operations strategies, global location, global sourcing and logistics decisions, international workforce management, technology transfer and configuration, and coordination of global operations activities. *Preq:* MGT 803 or consent of instructor.

**MGT 829 Management of E-Commerce 3(3,0)** Concepts of electronic commerce as facilitated by the Internet and related technologies. Topics include the catalysts for e-commerce (both B2B and B2C), technological challenges, legal and regulatory framework, behavior and educational challenges, and strategies for e-commerce. *Preq:* Consent of instructor.

**MGT 830 E-Business Strategy 3(3,0)** Theory and practice of business strategy in the e-business firm, emphasizing building competitive advantage and increasing shareholder value through digital technologies. The roles of technical and general managers in electronic business are investigated through business cases and class discussion. MS in Management and MBA students may not receive credit for this course. *Preq:* M B A 876, MGT 829.

**MGT 833 E-Commerce Project 3(0,9)** Application of e-commerce knowledge to a significant problem or opportunity. *Preq:* Submission of a written proposal and consent of instructor.

**MGT (M B A) 845 Technology and Innovation Management 3(3,0)** See M B A 845.

**MGT 850 Business Decision Models 3(3,0)** Fundamental management science modeling techniques emphasizing problem formulation, computer solution, and economic analysis in an operations context; queuing analysis, computer simulation, and mathematical programming approaches including linear, goal, and integer programming. Application areas encompass production, capacity, and project planning, scheduling, location, layout, and logistics. *Preq:* Consent of instructor.

**MGT 852 Management Science II 3(3,0)** Continuation of MGT 850; dynamic, integer, and nonlinear programming emphasizing applications of different types of mathematical programming to business and industrial problems. *Preq:* MGT 850 or consent of instructor.

**MGT 854 Design of Experiments in Business and Management 3(3,0)** Design and analysis of experiments with a focus on business and industrial applications. Topics range from the analysis of single-factor experimental designs through factorial experiments, multiple comparisons, and confounding. Problems arising in the actual industrial environments are used to illustrate the application of the techniques and to introduce the student to major statistical software packages for the analysis of experimental data. Offered fall semester only.

**MGT (M B A) 861 Information Systems 3(3,0)** The critical role of information systems in contemporary business organizations; key information systems and technologies; their impacts both within and across organizational settings.

**MGT 866 System Analysis and Design 3(2,1)** Software engineering methods and techniques specific to analysis and design of information systems. Topics include concepts and methods for valuation of IT applications, data gathering, and process, data, and object-oriented modeling analysis and design.

**MGT 869 Project Management 3(3,0)** In-depth study, through case studies, readings, and hands-on experience, of processes and techniques to initiate, plan, execute, control, and close-out information technology projects. Topics include project integration, scope, time, cost, quality, human resource, communications, risk, and procurement management. *Preq:* Consent of instructor.



**MGT (M B A) 874 Managing Continuous Improvement 3(3,0)** How to initiate and lead change toward a total quality environment; basic tools of quality management; use of teams to achieve change; quality function deployment; ISO 9000; supplier development; and use of survey methods to track progress of change. *Preq:* MGT 803 or consent of instructor.

**MGT 885 Industrial Scheduling 3(3,0)** Theoretical results for single and parallel machine, flow shop, job shop, and network scheduling; treatment of mathematical programming applications, scheduling algorithm design and search procedures. *Preq:* One of the following: C E 835, CP SC 840, I E 803, M B A 859, MGT 850, MTHSC 812 or 814; and consent of instructor.

**MGT 888 International Perspectives in Industrial Management 3-6(3-6, 0)** International perspective to industrial management via organized plant visitations to businesses in a foreign country and lectures by, and discussions with, senior operations managers. Cultural visits and lectures are also organized to provide a holistic perspective to cover cultural and economic development of the host country. *Preq:* Consent of instructor.

**MGT 891 Master's Thesis Research 1-12**

**MGT 892 Master's Project Course 3(0,9)** Field project, the capstone activity in the program, requiring application of the program body of knowledge to a real-world operations management problem. Formal presentation and written report are required. May be repeated for a maximum of 12 credits. To be taken Pass/Fail only. *Preq:* Consent of instructor.

**MGT 899 Selected Topics in Industrial Management 3(3,0)** Current topics in industrial management theory and/or practice. Topics vary in keeping with developments in the management profession and interests of faculty. May be repeated for a maximum of nine credits.

**MGT 903 Seminar in Manufacturing Planning and Control Systems 3(3,0)** Current research issues and developments in manufacturing planning and control systems emphasizing research (philosophical, analytical, and empirical) dealing with alternative approaches for planning and control of manufacturing operations. *Preq:* MGT 808, consent of instructor.

**MGT 904 Seminar in Current Management Topics 3(3,0)** Topics from current management literature emphasizing research from scholarly journals. Topics vary in keeping with developments in the literature. May be repeated with different faculty for a maximum of six credits. *Preq:* MGT 803 or consent of instructor.

**MGT 905 Research Methods 3(3,0)** Research methods supporting scholarly research and publication in management. Topics include theory building, hypothesis specification and testing, experimental design, measurement, sampling, research ethics, and related issues. Restricted to doctoral students. *Preq:* MGT 854 or equivalent.

**MGT 907 Seminar in the Design of Operations Systems 3(3,0)** Current management issues and developments in the evaluation, selection, design, and installation of systems for manufacturing and service operations; empirical research dealing with the building blocks of operations such as process technology scanning, selection, and installation; operations systems location and layout; and management systems selection and installation. *Preq:* MGT 821, consent of instructor.

**MGT 910 Seminar in Operations Management 1-3(1-3,0)** New methodological developments, both analytical and philosophical, in operations management; development of theory of management science; converting management theory into practice while considering behavioral and economic aspects of the problem. *Preq:* Consent of instructor.

**MGT 911 Seminar in Decision Theory 1-3(1-3,0)** Framework and methodology for management decision making in a statistical setting. *Preq:* Consent of instructor.

**MGT 913 Management Systems Analysis 3(3,0)** Design, construction, and analysis of stochastic simulation models for typical management decisions; design; input-output; variance reduction; applications; validation; implementation; optimum seeking techniques; designed experiments; effect of model results on managerial policy decisions.

**MGT 916 Directed Readings in Management 1-3(1-3,0)** Directed reading and research in the student's area of interest. May be repeated for a maximum of three credits. *Preq:* Consent of instructor.

**MGT 918 Seminar in Management Support Systems 3(3,0)** Contemporary topics in decision-oriented information systems research; structure of the field, research methodologies, and research opportunities. *Preq:* MGT 818 or consent of instructor.

**MGT 921 Seminar in the Science and Practice of Business and Economic Modeling 3(3,0)** Current literature used as a resource for studying and analyzing selected topics important in the design and development of simulation models. Students lead and participate in group discussions. *Preq:* MGT 913 or equivalent.

**MGT 925 Seminar on Information Systems Foundations 3(3,0)** Foundations of information systems research including classical framework literature. Research philosophies, key methodologies and relevant theoretical underpinnings are discussed and debated.

**MGT 927 Seminar in Organizational Impacts of Information Systems 3(3,0)** Current theoretical and empirical research related to the organizational impacts of information systems. Research focuses on strategic and structural impacts of information technologies within and across organizations.

**MGT 991 Doctoral Dissertation Research 1-12**

## MARKETING

**MKT 623 Promotional Strategy 3(3,0)** Emphasizes promotion as the communication function of marketing. Attention is given to communication theory and promotion's relation to mass and interpersonal communication. Factors affecting the promotional decision-making process are explored, and promotion as a competitive tool is examined. *Preq:* MKT 301 or consent of instructor.

**MKT 627 International Marketing 3(3,0)** Study of marketing from the international point of view. Emphasis is on the necessary modification of marketing thinking and practice for foreign markets due to individual environmental differences. *Preq:* MKT 301.

**MKT 628 Services Marketing 3(3,0)** Exploration and study of the nature of service organizations and the principles that guide the marketing of their products. Emphasis is on a marketing mix that is fundamentally different than that found in traditional goods marketing. *Preq:* MKT 301 or consent of instructor.

**MKT 629 Public and Nonprofit Marketing 3(3,0)** Examines the role and application of marketing in public and nonprofit settings. Focuses on a conceptual understanding of the marketing discipline and marketing processes and shows how basic concepts and principles of marketing are applicable to public and nonprofit organizations. *Preq:* MKT 301 or consent of instructor.

**MKT 630 Marketing Product Management 3(3,0)** Management of the firm's product or service offerings. Topics include new product screening, evaluation, and development; product line and mix analysis; abandonment decisions; brand manager's role; new product development department and others. Emphasis is on decision making. *Preq:* MGT 310, MKT 301; or consent of instructor.

**MKT 631 Marketing Research 3(3,0)** Research used in marketing decision making. Primary emphasis is on methods and techniques used in planning, collecting, processing and utilizing information. Topics include research design, sources of information, questionnaire design, sampling, data collection, and data analysis. *Preq:* MGT 310, MKT 301, MTHSC 301; or consent of instructor.

**MKT 695 Selected Topics 3(3,0)** In-depth examination of timely topics in marketing. May be repeated for credit, but only if different topics are covered. *Preq:* MKT 301 or consent of instructor.

**MKT (M B A) 824 Management of Sales Operations 3(3,0)** See M B A 824.

**MKT (M B A) 825 Advertising and Promotional Management 3(3,0)** See M B A 825.

**MKT (M B A) 826 Business Marketing 3(3,0)** See M B A 826.

**MKT (M B A) 828 Services Marketing 3(3,0)** See M B A 828.

**MKT (M B A) 860 Advanced Marketing Strategy 3(3,0)** See M B A 860.



**MKT 861 Marketing Research 3(3,0)** Marketing theory and critical thinking to support decision making; data analysis and advanced marketing models are employed with emphasis on building assessment skills. Primary topics are gathering primary and secondary data, questionnaire design, sampling, experimental design, data collection, and data analysis. *Preq:* Enrollment in MS in Marketing or M B A (MKT) 860 or consent of instructor.

**MKT 862 Quantitative Methods in Marketing 3(3,0)** Advanced quantitative analytic methods and their use in translating facts into meaningful information. Provides practical understanding of several advance quantitative data analytic procedures including both predictive and interdependence techniques. Application to case analysis format to broaden analysis skills. *Preq:* MKT 861 or consent of instructor.

**MKT 863 Buyer Behavior 3(3,0)** Buyer decision processes in the purchase and consumption of goods and services by both businesses and consumers. Topics include economic, sociocultural, and psychological aspects of buying behavior; decision-making processes and buyer choice; individual and group level influences on consumer behavior; and implications of consumer behavior for marketers. *Preq:* Enrollment in MS in Marketing or M B A (MKT) 860 or consent of instructor.

**MKT 865 Seminar in Marketing Management 3(3,0)** Current research and practice in components of marketing management. In-depth discussion of marketing mix variables, segmentation, targeting and positioning, and budget-related issues. *Preq:* Enrollment in MS in Marketing.

**MKT 866 Selected Topics in Marketing 3(3,0)** Current topics in marketing theory and research. Topics vary with developments in the marketing profession. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* M B A (MKT) 860 or MKT 865 or consent of instructor.

**MKT 870 Master's Research Project 1-5** Student development and participation in research. Application to a current business problem or development of new research. Formal presentation and written report are required. May be repeated for a maximum of five credits. *Preq:* Enrollment in MS in Marketing and consent of graduate advisor.

## MASTER OF BUSINESS ADMINISTRATION (MBA)

*See courses listed under Business Administration.*

## MATERIALS SCIENCE AND ENGINEERING

**MS&E 800 Seminar in Materials Research 1(1,0)** Special topics and original research in materials engineering. Credit may be earned for more than one semester.

**MS&E 811 Materials Science and Engineering I: Structure, Bonding, and Synthesis 4(4,0)** Fundamentals of materials science and engineering; crystal structures, chemical and atomic bonding, mechanical properties, periodicity in relation to material engineering, methods of materials synthesis. *Preq:* BS degree in Materials Science and Engineering, Physics, Chemistry, or appropriate engineering discipline or consent of instructor.

**MS&E 812 Materials Science and Engineering II: Electronic, Magnetic, Thermal, and Optical Properties of Materials 4(4,0)** Continuation of MS&E 811: electronic, magnetic, thermal, and optical properties of materials; structure/properties and application of metals, semiconductors, ceramics, and polymers and their importance in materials science and engineering. *Preq:* MS&E 811 or consent of instructor.

**MS&E 820 Deformation Mechanisms in Solids 3(3,0)** Dislocation theory of solids; mechanisms of plastic deformation in single crystals and polycrystalline aggregates of metals and nonmetals; ductile and brittle fractures; fatigue, creep, and stress corrosion cracking of metals. *Preq:* Consent of instructor.

**MS&E 825 Solid State Materials Science 3(3,0)** Bonding and structure of crystalline materials as related to mechanical, thermal, and chemical properties of solids.

**MS&E 826 Phase Equilibria in Materials Systems 3(3,0)** Advanced treatment of phase equilibria in materials systems, phase diagrams, thermodynamics of defects, surfaces, interfaces, and solutions. *Preq:* C M E 210; consent of instructor. *Coreq:* M E 810.

**MS&E 827 Kinetics of Phase Transformation 3(3,0)** Advanced treatment of the kinetics of phase transformation in materials systems including nucleation, growth, and spinodal decomposition. *Preq:* MS&E 826 or equivalent, consent of instructor.

**MS&E 828 Phase Transformations in Materials Science 3(3,0)** Advanced treatment of gas-solid, gas-liquid, liquid-solid, and solid-solid transformations in materials systems. *Preq:* MS&E 827.

**MS&E 891 Master's Thesis Research 1-12**

**MS&E 991 Doctoral Dissertation Research 1-12**

## MATHEMATICAL SCIENCES

**MTHSC 600 Theory of Probability 3(3,0)** Principal topics include combinatorial theory, probability axioms, random variables, expected values, special discrete and continuous distributions, jointly distributed random variables, correlation, conditional expectation, law of large numbers, central limit theorem. *Preq:* MTHSC 206 or consent of instructor.

**MTHSC 603 Introduction to Statistical Theory 3(3,0)** Principal topics include sampling distributions, point and interval estimation, maximum likelihood estimators, method of moments, least squares estimators, tests of hypotheses, likelihood ratio methods, regression and correlation analysis, introduction to analysis of variance. *Preq:* MTHSC 400 or equivalent.

**MTHSC 605 Statistical Theory and Methods II 3(3,0)** Principal topics include simple linear regression, multiple regression and correlation analysis, one-way analysis of variance, multiple comparison, multifactor analysis of variance, experimental design. Computation and interpretation of results are facilitated through use of statistical computer packages. *Preq:* MTHSC 301.

**MTHSC 606 Sampling Theory and Methods 3(3,0)** Probability-based treatment of sampling methodology. Theory and application of estimation techniques are treated using simple and stratified random sampling, cluster sampling, and systematic sampling. *Preq:* MTHSC 302 and 400, or consent of instructor.

**MTHSC 607 Regression and Time Series Analysis 3(3,0)** Theory and application of the regression and time series. Approaches to empirical model building and data analysis are treated. Computation and interpretation of results are facilitated through the use of interactive statistical packages. *Preq:* MTHSC 302, 311, 400; or consent of instructor.

**MTHSC 608 Topics in Geometry 3(3,0)** Introduction to topics in special geometries which include non-Euclidean space concepts such as projective geometry, finite geometries, and intuitive elementary topology. Brief introduction to vector geometry. *Preq:* MTHSC 206.

**MTHSC 612 Introduction to Modern Algebra 3(3,0)** Introduction to the concepts of algebra. Topics include the number system and the elementary theory of groups, rings, and fields. *Preq:* MTHSC 311.

**MTHSC 619 Discrete Mathematical Structures I 3(3,0)** Applies theoretical concepts of sets, functions, binary relations, graphs, Boolean algebras, propositional logic, semigroups, groups, homomorphisms, and permutation groups to computer characteristics and design, words over a finite alphabet and concatenation, binary group codes, and other communication or computer problems. *Preq:* MTHSC 311.

**MTHSC 634 Advanced Engineering Mathematics 3(3,0)** Fourier series, Laplace and Fourier transform, and numerical methods for solving initial value and boundary-value problems in partial differential equations are developed. Applications to diffusion wave and Dirichlet problems are given. Matrix methods and special functions are utilized. *Preq:* MTHSC 208.

**MTHSC 635 Complex Variables 3(3,0)** Elementary functions; differentiation and integration of analytic functions; Taylor and Laurent series; contour integration and residue theory; conformal mapping; Schwarz-Christoffel transformation. *Preq:* MTHSC 206.



**MTHSC 640 Linear Programming 3(3,0)** Introduction to linear programming covering the simplex algorithm, duality, sensitivity analysis, network models, formulation of models, and the use of simplex codes to solve, interpret, and analyze problems. *Preq:* MTHSC 206, 311, or consent of instructor.

**MTHSC 641 Introduction to Stochastic Models 3(3,0)** Introductory treatment of stochastic processes, finite-state Markov chains, queueing, dynamic programming, Markov decision processes, reliability, decision analysis, and simulation. Both theory and applications are stressed. *Preq:* MTHSC 400.

**MTHSC 653 Advanced Calculus I 3(3,0)** Limits, continuity, and differentiation of functions of one and several variables, the Riemann integral, and vector analysis. *Preq:* MTHSC 206.

**MTHSC 654 Advanced Calculus II 3(3,0)** Continuation of MTHSC 653. Transformations, multiple integrals, line and surface integrals, infinite sequences and series, and improper integrals. *Preq:* MTHSC 453.

**MTHSC 660 Introduction to Numerical Analysis I 3(3,0)** Introduction to the problems of numerical analysis emphasizing computational procedures and application. Topics include sources of error and conditioning, matrix methods, systems of linear equations, nonlinear equations, interpolation and approximation by splines, polynomials and trigonometric functions. *Preq:* MTHSC 206 or 207 and 360 or equivalent.

**MTHSC 663 Mathematical Analysis I 3(3,0)** Basic properties of the real number system, sequences and limits; continuous functions, uniform continuity and convergence; integration, differentiation, functions of several real variables, implicit function theory. *Preq:* MTHSC 206.

**MTHSC 709 Geometry for the Middle Grades 3(3,0)** Hands-on approach to constructions with straight-edge and compass; polygons including tessellations and polyhedra; symmetry and transformational geometry; coordinate geometry measurement with dimensional analysis; perspective drawing and related topics; history of geometry; reasoning and informal proof with congruence; and computer software, calculator use, and Internet.

**MTHSC 715 Quantitative Literacy I 3(3,0)** Data analysis and gathering data from surveys including box-and-whisker plots, bar charts, circle graphs, and stem-and-leaf plots. Construction of surveys to gather data to test a hypothesis. All material are presented by student activities using cooperative learning and manipulatives.

**MTHSC 716 Quantitative Literacy II 3(3,0)** Probability and simulation; application of these concepts to simulate various processes such as traffic control. All material are presented by student activities using cooperative learning and manipulatives.

**MTHSC 719 Discrete Mathematics 3(3,0)** Discrete mathematics emphasizing applications to computer science; propositions and logic; Boolean Algebra and switching circuits; recursion and induction; relations and partially ordered sets, graphs, and trees.

**MTHSC 721 Matrix Algebra 3(3,0)** Matrices and systems of equations; determinants; vector spaces and linear transformations; eigenvalues. Restricted to graduate students in Secondary Education.

**MTHSC 723 Applications of Linear and Modern Algebra 3(3,0)** Various applied problems whose solutions rely on techniques and results of linear and modern algebra. Problems are selected from such areas as economics, forest management, genetics, population growth, transportation networks, cryptography, satellite communications, electronic switching circuits, chemistry, physics, sociology, and others. *Preq:* MTHSC 721 or equivalent or consent of instructor.

**MTHSC 725 Combinatorial Mathematics for Teachers 3(3,0)** Permutations; combinations; generating functions; recurrence relations; principle of inclusion-exclusion; partitions; Latin squares; block designs; finite geometries; graphs; codes; Polya's theorem; recreational mathematics. *Preq:* Enrollment in Secondary Education graduate program.

**MTHSC 727 Analysis Concepts for Teachers 3(3,0)** Elementary functions, differential calculus and integral calculus; enrichment material and a theoretical perspective of calculus. Restricted to teachers who hold a current teaching certificate in secondary mathematics. Completion of this course satisfies the special certification requirements for AB-calculus teachers in South Carolina.

**MTHSC 730 Modern Geometry for Teachers 3(3,0)** Concepts of Euclidean geometry reviewed and extended by means of coordinates, vectors, matrices; conic sections. *Preq:* Enrollment in Secondary Education graduate program.

**MTHSC 741 Introduction to Linear Programming with Applications 3(3,0)** Development of mathematical theory of simplex algorithm; survey of mathematical background; matrix algebra, systems of linear equations and vector spaces; problem formulation is emphasized. *Preq:* Enrollment in Secondary Education graduate program.

**MTHSC 761 Probability and Statistics for Teachers 3(3,0)** Topics include probability, conditional probability, descriptive statistics, random variables, probability functions, binomial distribution, normal distribution, sampling, estimation, decision making. *Preq:* Enrollment in Secondary Education graduate program.

**MTHSC 783 Theory of Numbers 3(3,0)** Topics include properties of integers, divisors, and prime numbers; fundamental properties of congruence; polynomials and primitive roots; quadratic residues. *Preq:* Enrollment in Secondary Education graduate program.

**MTHSC 791 Selected Topics in Mathematics Education 1-3(1-3,0)** Mathematical problems in elementary or secondary school curricula. Restricted to graduate students in Elementary or Secondary education. May be repeated for credit, but only if different topics are covered.

**MTHSC 800 Probability 3(3,0)** Study of basic probability theory with emphasis on results and techniques useful in operations research and statistics. Topics include axiomatic probability, advanced combinatorial probability, conditional in formative expectation, functions of random variables, moment generating functions, distribution theory, and limit theorems. Offered fall semester only. *Preq:* MTHSC 206.

**MTHSC 801 General Linear Hypothesis I 3(3,0)** Topics include least-square estimates; Gauss Markov theorem; confidence ellipsoids, and confidence intervals for estimable functions; tests of hypotheses; one-, two-, and higher-way layouts; analysis of variance for other models. Offered fall semester only. *Preq:* MTHSC 311, 403.

**MTHSC 802 General Linear Hypothesis II 3(3,0)** Continuation of MTHSC 801. Offered spring semester only.

**MTHSC 803 Stochastic Processes 3(3,0)** Theory and analysis of time series, recurrent events Markov chains, random walks, renewal theory application to communication theory and operations research. *Preq:* MTHSC 400 or 800.

**MTHSC 804 Statistical Inference 3(3,0)** Sampling distributions; maximum likelihood estimation and likelihood ratio tests; asymptotic confidence intervals for Binomial, Poisson, and Exponential parameters; two-sample methods; nonparametric tests; ANOVA; regression; model building. Offered fall semester only. *Preq:* MTHSC 400 or equivalent or consent of instructor.

**MTHSC 805 Data Analysis 3(3,0)** Methodology in analysis of statistical data emphasizing applications to real problems using computer-oriented techniques: computer plots, transformations, criteria for selecting variables, error analysis, multiple and stepwise regression, analysis of residuals, model building in time series and ANOVA problems, jackknife and random subsampling, multidimensional scaling, clustering. *Preq:* MTHSC 301, 400.

**MTHSC 806 Nonparametric Statistics 3(3,0)** Order statistics; tolerance limits; rank-order statistics; Kolmogorov-Smirnov one-sample statistics; Chi-square goodness-of-fit test; two-sample problem; linear rank statistics; asymptotic relative efficiency. Offered spring semester only. *Preq:* MTHSC 600 or 800.

**MTHSC 807 Applied Multivariate Analysis 3(3,0)** Applied multivariate analysis: computer plots of multivariate observations; multidimensional scaling; multivariate tests of means, covariances, and equality of distributions; univariate and multivariate regressions and their comparisons; MANOVA; principal components analysis; factor analysis; analytic rotations; canonical correlations. Offered fall semester only. *Preq:* MTHSC 403 and 805 or consent of instructor.

**MTHSC 808 Reliability and Life Testing 3(3,0)** Probability models and statistical methods relevant to parametric and nonparametric analysis of reliability and life testing data. Offered spring semester only. *Preq:* MTHSC 400 or equivalent.



**MTHSC 809 Time Series Analysis, Forecasting, and Control 3(3,0)** Modeling and forecasting random processes; autocorrelation functions and spectral densities; model identification, estimation and diagnostic checking; transfer function models; feedforward and feedback control schemes. Offered spring semester only. *Preq:* MTHSC 605; 600 or 800; or equivalent.

**MTHSC 810 Mathematical Programming 3(3,0)** Formulation and solution of linear programming models; mathematical development of the simplex method; revised simplex method; duality; sensitivity analysis; parametric programming, implementation and software packages. *Preq:* MTHSC 311.

**MTHSC 811 Nonlinear Programming 3(3,0)** Theoretical development of nonlinear optimization with applications, classical optimization, convex and concave functions, separable programming, quadratic programming, and gradient methods. Offered spring semester only. *Preq:* MTHSC 440, 454.

**MTHSC 812 Discrete Optimization 3(3,0)** Principal methods used in integer programming and discrete optimization; branch and bound, implicit enumeration, cutting planes, group knapsack, Lagrangian relaxation, surrogate constraints, heuristics (performance analysis), separation/branching strategies, and polynomial time algorithms for specific problems on special structures. Offered fall semester only. *Preq:* MTHSC 810 or equivalent.

**MTHSC 813 Advanced Linear Programming 3(3,0)** Development of linear programming theory using inequality systems, convex cones, polyhedra and duality; solution algorithms, and computational considerations for large scale and special structured problems using techniques of upper bounded variables, decomposition, partitioning and column generation; game theory; nonlinear representations and other methods such as ellipsoid and Karmarkar. Offered spring semester only. *Preq:* MTHSC 440, 810 or equivalent.

**MTHSC 814 Network Flow Programming 3(3,0)** Max-flow/min-cut theorem, combinatorial applications, minimum cost flow problems (transportation, shortest path, transshipment), solution algorithms (including the out-of-kilter), and implementation and computational considerations. Offered fall semester only. *Preq:* MTHSC 440, 810 or equivalent.

**MTHSC 816 Network Algorithms and Data Structures 3(3,0)** Design, analysis, and implementation of algorithms and data structures associated with the solution of problems formulated as networks and graphs; applications to graph theory, combinatorial optimization, and network programming. Offered spring semester only. *Coreq:* MTHSC 640, 810, 854, 863 or consent of instructor.

**MTHSC 817 Stochastic Models in Operations Research I 3(3,0)** Stochastic control; structure of sequential decision processes; stochastic inventory models; recursive computation of optimal policies; discrete parameter finite Markov decision processes; various optimality criteria; computation by policy improvement and other methods; existence of optimal stationary policies; stopping-rule problems; examples from financial management, maintenance and reliability, search, queuing, and shortest path. Offered spring semester only. *Preq:* MTHSC 803.

**MTHSC 818 Stochastic Models in Operations Research II 3(3,0)** Introduction to queuing theory: Markovian queues, repairman problems, queues with an embedded Markov structure, the queue GI/G/1, queues with a large number of servers, decision making in queues; introduction to reliability theory; failure distributions; stochastic models for complex systems; maintenance and replacement policies; reliability properties of multicomponent structures. Offered fall semester only. *Preq:* MTHSC 817.

**MTHSC 819 Multicriteria Optimization 3(3,0)** Theory and methodology of optimization problems with vector-valued objective functions; preference orders and domination structures; generating efficient solutions; solving multicriteria decision-making problems; noninteractive and interactive methods with applications. Offered fall semester only. *Preq:* MTHSC 810 or equivalent.

**MTHSC 820 Complementarity Models 3(3,0)** Theory, algorithms, and applications of linear and nonlinear complementarity; classes of matrices and functions and corresponding algorithms; applications to economics, mechanics, and networks; generalizations to fixed-point problems and nonlinear systems of equations. Offered spring semester only. *Preq:* MTHSC 810.

**MTHSC 821 Linear Analysis 3(3,0)** Normed spaces; Hilbert spaces, Banach spaces, linear functionals, linear operators, orthogonal systems. Offered spring semester and summer session only. *Preq:* MTHSC 454 or 453 and 853.

**MTHSC 822 Measure and Integration 3(3,0)** Rings and algebras of sets, inner and outer measures; measurability and additivity, examples on the line and in space, Lebesgue integration, types of convergence, Lebesgue spaces; integration and differentiation, product measure, Fubini theorem. Offered fall semester only. *Preq:* MTHSC 454.

**MTHSC 823 Complex Analysis 3(3,0)** Topological concepts; complex integration; local and global properties of analytic functions; power series; representation theorems; calculus of residues. Designed for nonengineering majors.

**MTHSC 825 Introduction to Dynamical Systems Theory 3(3,0)** Techniques of analysis of dynamical systems; sensitivity analysis, linear systems, stability, and control; theory of differential and difference equations. Offered fall semester only. *Preq:* MTHSC 454 and 311 or 453 and 853.

**MTHSC 826 Partial Differential Equations 3(3,0)** First-order equations: elliptic, hyperbolic, and parabolic. Second-order equations: existence and uniqueness results, maximum principles, finite difference, and Hilbert Space methods. Offered fall semester only. *Preq:* MTHSC 821 or consent of instructor.

**MTHSC 827 Dynamical System Neural Networks 3(3,0)** Modeling problems in the context of dynamical systems theory; useful methods from Lyapunov stability, local linearization, qualitative analysis using graph theory and numerical approximations; several dynamical systems neural networks including binary code recognizers and binary matrix choosers. *Preq:* MTHSC 206, 311.

**MTHSC 831 Fourier Series 3(3,0)** Fourier series with applications to solution of boundary value problems in partial differential equations of physics and engineering. Introduction to Bessel functions and Legendre polynomials.

**MTHSC 837 Calculus of Variations and Optimal Control 3(3,0)** Fundamental theory of the calculus of variations; variable end points; the parametric problem; the isoperimetric problem; constraint inequalities; introduction to the theory of optimal control; connections with the calculus of variations; geometric concepts. *Preq:* MTHSC 453 or 463.

**MTHSC 841 Applied Mathematics I 3(3,0)** Derivation of equations from conservation laws, dimensional analysis, scaling and simplification; methods such as steepest descent, stationary phase, perturbation series, boundary layer theory, WKB theory, multiple-scale analysis, and ray theory applied to problems in diffusion processes, wave propagation, fluid dynamics, and mechanics. Offered fall semester only. *Preq:* MTHSC 208 and 453 or 463.

**MTHSC 842 Applied Mathematics II 3(3,0)** Continuation of MTHSC 841.

**MTHSC 851 Abstract Algebra I 3(3,0)** Basic algebraic structures: groups, rings, and fields; permutation groups, Sylow theorems, finite abelian groups, polynomial domains, factorization theory, and elementary field theory. Offered spring semester only.

**MTHSC 852 Abstract Algebra II 3(3,0)** Continuation of MTHSC 851 including selected topics from ring theory and field theory. Offered fall semester only.

**MTHSC 853 Matrix Analysis 3(3,0)** Topics in matrix analysis that support an applied curriculum: similarity and eigenvalues; Hermitian and normal matrices; canonical forms; norms; eigenvalue localizations; singular value decompositions; definite matrices. *Preq:* MTHSC 311, 453 or 463.

**MTHSC 854 Theory of Graphs 3(3,0)** Connectedness; path problems; trees; matching theorems; directed graphs; fundamental numbers of the theory of graphs; groups and graphs. Offered spring semester only. *Preq:* Consent of instructor.



**MTHSC 855 Combinatorial Analysis 3(3,0)** Combinations; permutations; permutations with restricted position; Polya's theorem; principle of inclusion and exclusion; partitions; recurrence relations; generating functions; Mobius inversion; enumeration techniques; Ramsey numbers; finite projective and affine geometries; Latin rectangles; orthogonal arrays; block designs; error detecting and error correcting codes. Offered fall semester only. *Preq:* MTHSC 311.

**MTHSC 856 Applicable Algebra 3(3,0)** Applied algebraic ideas in lattice theory and Boolean Algebra; finite-state sequential machines; group theory as applied to network complexity and combinatorial enumeration; algebraic coding theory. Topics vary with background and interests of students. Offered spring semester only. *Preq:* MTHSC 851 and 853 or consent of instructor.

**MTHSC 860 Introduction to Scientific Computing 3(3,0)** Floating point models, conditioning and numerical stability, numerical linear algebra, integration, systems of ordinary differential equations and zero finding; emphasis is on the use of existing scientific software. *Preq:* CP SC 110, MTHSC 208, 311.

**MTHSC 861 Advanced Numerical Analysis I 3(3,0)** Interpolation and approximation; numerical quadrature; numerical solution of functional differential equations; integral equations and overdetermined linear systems; eigenvalue problems; approximation using splines. Offered fall semester only. *Preq:* MTHSC 453, 460.

**MTHSC 863 Digital Models I 3(3,0)** Experimental mathematics; pseudo-stochastic processes; analytical and algebraic formulations of time-independent simulation; continuous-time simulation and discrete-time simulation; digital optimization; Fibonacci search; ravine search; gradient methods; current research in digital analysis. Offered fall semester only. *Preq:* MTHSC 311, 453, digital computer experience.

**MTHSC 865 Data Structures 3(3,0)** Representation and transformation of information; formal description of processes and data structures; tree and list structures; pushdown stacks; string and formula manipulation; hashing techniques; interrelation between data structure and program structure; storage allocation methods. Offered fall semester only. *Preq:* Computational maturity, consent of instructor.

**MTHSC 881 Mathematical Statistics 3(3,0)** Fundamental concepts of sufficiency, hypothesis testing and estimation; robust estimation; resampling (jackknife, bootstrap, etc.) methods; asymptotic theory; two-stage and sequential sampling problems; ranking and selection procedures. Offered spring semester only. *Preq:* MTHSC 403 or equivalent.

**MTHSC 884 Statistics for Experimenters 3(3,0)** Statistical methods for students who are conducting experiments; introduction to descriptive statistics, estimation, and hypothesis testing as they relate to design of experiments; higher-order layouts, factorial and fractional factorial designs, and response surface models. Offered fall semester only. *Preq:* MTHSC 206 or equivalent.

**MTHSC 885 Advanced Data Analysis 3(3,0)** Continuation of MTHSC 805 covering alternatives to ordinary least squares, influence and diagnostic considerations, robustness, special statistical computation methods. Offered spring semester only. *Preq:* MTHSC 603, 800, 805.

**MTHSC 891 Master's Thesis Research 1-12**

**MTHSC 892 Master's Project Course 1(0,1)** For students in the nonthesis option of the MS degree program in Mathematical Sciences. Successful completion includes a presentation of the master's project to the student's advisory committee and acceptance of the paper by the committee.

**MTHSC 900 Seminar in Preparing for College Teaching in the Mathematical Sciences 3(3,0)** Elements involved in being a college professor with emphasis on broadening the student's mathematical experiences within a framework of improving classroom performance. *Preq:* Completion of the departmental PhD qualifying examinations.

**MTHSC 901 Probability Theory I 3(3,0)** Axiomatic theory of probability; distribution functions; expectation; Cartesian product of infinitely many probability spaces, and the Kolmogorov consistency theorem; models of convergence; weak and strong laws of large numbers. *Preq:* MTHSC 400 and 822, or MTHSC 800 and 822 or consent of instructor.

**MTHSC 902 Probability Theory II 3(3,0)** Continuation of MTHSC 901; characteristic functions, infinitely divisible distributions, central limit theorems, laws of large numbers, conditioning, and limit properties of sums of dependent random variables, conditioning, martingales. *Preq:* MTHSC 901.

**MTHSC 927 Functional Analysis 3(3,0)** Linear operators on specific spaces, spectral theory, semi-groups of operators and the Hille-Yosida theorem, applications of linear spaces and operators, convexity. *Preq:* MTHSC 821.

**MTHSC 954 Advanced Graph Theory 3(3,0)** Continuation of MTHSC 854 including the four-color theorem, domination numbers, Ramsey theory, graph isomorphism, embeddings, algebraic graph theory, and tournaments. Research papers are also examined. Offered fall semester only. *Preq:* MTHSC 854 or consent of instructor.

**MTHSC 970 Directed Studies in Mathematical Sciences 1-3(1-3,0)** Directed individual studies on topics in the mathematical sciences supervised by faculty. May be repeated for a maximum of 18 credits. *Preq:* Consent of instructor.

**MTHSC 974 Selected Topics in Mathematical Sciences 3(3,0)** Advanced topics in the mathematical sciences from current areas of interest presented in lecture format. May be repeated for a maximum 24 credits, but only if different topics are covered. *Preq:* Consent of instructor.

**MTHSC 981 Selected Topics in Mathematical Statistics and Probability 1-3(1-3,0)** Advanced topics in mathematical statistics and probability of current interest. May be repeated for credit, but only if different topics are covered.

**MTHSC 982 Selected Topics in Analysis 1-3(1-3,0)** Advanced analysis topics from current problems of interest. May be repeated for credit, but only if different topics are covered.

**MTHSC 983 Selected Topics in Computational Mathematics 1-3(1-3,0)** Advanced topics in computational mathematics and numerical analysis from current problems of interest. May be repeated for credit, but only if different topics are covered.

**MTHSC 985 Selected Topics in Algebra and Combinatorics 1-3(1-3,0)** Advanced topics in algebra and combinatorics from current problems of interest. May be repeated for credit, but only if different topics are covered.

**MTHSC 986 Selected Topics in Geometry 1-3(1-3,0)** Advanced topics in geometry from current problems of interest. May be repeated for credit, but only if different topics are covered.

**MTHSC 988 Selected Topics in Operations Research 1-3(1-3,0)** Advanced topics in operations research from current problems of interest. May be repeated for credit, but only if different topics are covered.

**MTHSC 989 Selected Topics in Mathematical Education 3(3,0)** Advanced topics in the mathematical sciences from the area of mathematics education. May be repeated for credit, but only if different topics are covered. *Preq:* Consent of instructor.

**MTHSC 991 Doctoral Dissertation Research 1-12**

## MECHANICAL ENGINEERING

**M E 607 Applied Heat Transfer 3(3,0)** Application-oriented extension of M E 304 considering topics in transient conduction, flow of fluids, energy exchange by radiation, and mass transfer. Applications in heat-exchanger design with emphasis on economics and variation of operating conditions from the design point. *Preq:* M E 304, consent of instructor.

**M E 616 Control of Mechanical Systems 3(3,0)** Physical modeling and feedback principles are presented for control of mechanical systems. Transient response, root locus, and frequency response principles are applied to the control of basic mechanical systems such as electric motors, fluid tanks, or thermal processes. PID control laws are emphasized. *Preq:* M E 305.

**M E 617 Mechatronics System Design 3(3,0)** Mechatronics integrates control, sensors, actuators, and computers to create a variety of electromechanical products. Includes concepts of design, appropriate dynamic system modeling, analysis, sensors, actuating devices, and real-time microprocessor interfacing and control. Case studies, simulation, and projects are used to exemplify the system design principles. *Preq:* M E 305 or consent of instructor.

**M E 620 Energy Sources and Their Utilization 3(3,0)** Covers availability and use of energy sources such as fossil fuels, solar (direct and indirect), and nuclear. Addresses energy density and constraints to use (technical and economic) for each source. *Preq:* M E 303, 304.

**M E 621 Introduction to Compressible Flow 3(3,0)** Introductory concepts to compressible flow; methods of treating one-dimensional gas dynamics including flow in nozzles and diffusers, normal shocks, moving and oblique shocks, Prandtl-Meyer Flow, Fanno Flow, Rayleigh Flow, and reaction propulsion systems. *Preq:* M E 303, 308.



- ME 622 Design of Gas Turbines 3(3,0)** Guiding principles in gas turbine cycles are reviewed. Turbine and compressor design procedures and performance prediction for both axial and radial flow machines are presented. Methods of design of rotary heat-exchangers and retrofitting gas turbine for regenerative operation are presented. Design projects are used to illustrate the procedures. *Preq:* ME 308.
- ME 623 Introduction to Aerodynamics 3(3,0)** Basic theories of aerodynamics for accurately predicting the aerodynamic forces and moments which act on a vehicle in flight. *Preq:* ME 308.
- ME 629 Thermal Environmental Control 3(3,0)** Mechanical vapor compression refrigeration cycles, refrigerants, thermoelectrical cooling systems, cryogenics, thermodynamic properties of air, psychometric charts, heating and cooling coils, solar radiation, heating and cooling loads, insulation systems. *Preq:* ME 303, 308.
- ME 630 Mechanics of Composite Materials 3(3,0)** Fundamental relationships for predicting the mechanical and thermal response of multi-layered materials and structures are developed. Micromechanical and macromechanical relationships are developed for laminated materials with emphasis on continuous filament composites. The unique nature of composites and the advantages of designing with composites are discussed. *Preq:* ME 302.
- ME 632 Advanced Strength of Materials 3(3,0)** Topics in strength of materials not covered in ME 302. Three-dimensional stress and strain transformations, theories of failure, shear center, unsymmetrical bending, curved beams, and energy methods. Other topics such as stress concentrations and fatigue concepts are treated as time permits. *Preq:* ME 302.
- ME 650 Mechanical Vibrations 3(3,0)** Mathematical analysis of physical problems in the vibration of mechanical systems. Topics include linear-free vibrations, forced vibrations, and damping in single degree of freedom systems, transient vibrations, critical speeds and whirling of rotating shafts, dynamic balancing, and multi-degree of freedom systems with lumped parameters. *Preq:* EM 202, ME 302, MTHSC 208.
- ME 653 Dynamic Performance of Vehicles 3(3,0)** Introduces techniques for analyzing the dynamic behavior of vehicles such as aircraft, surface ships, automobiles and trucks, railway vehicles, and magnetically levitated vehicles. *Preq:* ME 205, 305, or consent of instructor.
- ME 654 Design of Machine Elements 3(3,0)** Design of common machine elements including clutches, brakes, bearings, springs, and gears. Optimization techniques and numerical methods are employed as appropriate. *Preq:* ME 306 or consent of instructor.
- ME 655 Design for Computer-Automated Manufacturing 3(3,0)** Concepts of product and process design for automated manufacturing. Topics include product design for automated manufacturing, inspection and assembly using automation, industrial robots, knowledge-based systems, and concepts of flexible product manufacture. *Preq:* ME 301, 306, 404 (or concurrent enrollment) or consent of instructor.
- ME (ECE) 656 Fundamentals of Robotics 3(3,0)** Introduction to the fundamental mechanics and control of robots including their application to advanced automation. Topics include robot geometry, kinematics, dynamics, and control. Planar machine structures are emphasized, including methods using computer analysis. Application considerations include design and operation of robot systems for manufacturing and telerobotics. *Preq:* ME 305, 416 (or concurrent enrollment), or consent of instructor.
- ME 671 Computer-Aided Engineering Analysis and Design 3(3,0)** Students are exposed to geometric and solid modeling, finite elements, optimization, and rapid-prototyping. Students design an artifact, represent it on the computer, analyze it using FEA, then optimize before prototyping it. Emphasis is on the use of computer-based tools for engineering design. The World Wide Web is used for reporting. *Preq:* Numerical methods and programming experience or consent of instructor.
- ME 693 Selected Topics in Mechanical Engineering 1-6(1-6,0)** Study of topics not found in other courses. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.
- ME 801 Foundations of Fluid Mechanics 3(3,0)** Derivations of basic equations for multidimensional flow fields; analytical techniques for solving problems in laminar viscous flow and laminar inviscid flow; theories of similitude. *Preq:* Consent of instructor.
- ME 810 Macroscopic Thermodynamics 3(3,0)** First, second, and third laws of thermodynamics with engineering applications; thermodynamic property relations; chemical equilibrium. *Preq:* ME 312 or equivalent.
- ME 811 Gas Dynamics 3(3,0)** Concepts from thermodynamics, one-dimensional gas dynamics, one-dimensional wave motion, normal, and oblique shocks; flow in ducts and wind tunnels; two-dimensional equation of motion; small perturbation theory. *Preq:* Undergraduate course in fluid mechanics.
- ME 812 Experimental Methods in Thermal Science 3(2,2)** Theories of measurements, instrumentation, and techniques for measuring temperature, pressure, and velocity on a practical graduate engineering level; mathematical presentation of data, uncertainty analysis, data acquisition techniques, and theory and state-of-the-art measuring systems.
- ME 814 Concepts of Turbulent Flow 3(3,0)** Concepts of fluid turbulence; turbulent transport mechanisms, dynamics of turbulence, and experimental techniques pertinent to existing theories; classification of shear flows and their prediction methods. *Preq:* ME 801.
- ME (PHYS) 815 Statistical Thermodynamics I 3(3,0)** See PHYS 815.
- ME 818 Introduction to Finite Element Analysis 3(3,0)** Introduction to the finite element method; applications to heat transfer, fluid flow and solids; introduction to transient analysis; analysis strategies using finite elements; introduction to solid modeling, finite element modeling and analysis using commercial codes. *Preq:* Numerical methods course or consent of instructor.
- ME 819 Computational Methods in Thermal Sciences 3(3,0)** Numerical techniques as applied to the solution of fluid flow and heat transfer problems; use of finite difference methods.
- ME 820 Modern Control Engineering 3(3,0)** Mathematical modeling of engineering systems using differential and difference state equations; state variable time solutions using analytic and computer-aided analysis techniques; state control principles of controllability, observability, stability and performance specification; trade-offs between state variable and transfer function techniques. *Preq:* Undergraduate controls course or consent of instructor.
- ME 821 Advanced Control Engineering 3(3,0)** Concepts in multivariable, nonlinear, stochastic, and optimal control engineering; design and analysis considerations related to physical machines and processes; mathematical methods as needed. *Preq:* Undergraduate controls course or consent of instructor.
- ME 822 Computer Control of Automated Machines 3(3,0)** Concepts for control of automated manufacturing machines, cells and processes; logic and switching control; programmable controllers; supervisory hierarchical and expert control systems concepts for manufacturing; closed-loop direct digital control design including sampling, stability and response of discrete system models; design and application of computer control algorithms; computer requirements; sensors and signal conversion. *Preq:* ME 820 or consent of instructor.
- ME 829 Energy Methods and Variational Principles 3(3,0)** Application of variational principles in solid mechanics problems; virtual work; Castigliano's theorems on deflection and rotation; stationary potential energy; energy stability criterion; Hamilton's principle. *Preq:* ME 837 or consent of instructor.
- ME 830 Conduction and Radiation Heat Transfer 3(3,0)** Fundamental concepts related to conduction and radiation heat transfer; analytical methods for steady and transient conduction heat transfer in one and two physical dimensions; radiation exchange between surfaces with and without radiatively participating media; combined conduction and radiation heat transfer. *Preq:* ME 304 or equivalent.
- ME 831 Convective Heat Transfer 3(3,0)** Derivation of continuity, momentum, and energy equations for boundary layer flow; solutions for confined and external flow regimes in laminar and turbulent flow. *Preq:* ME 304 or equivalent, MTHSC 208.
- ME 832 Radiative Heat Transfer 3(3,0)** Radiation properties; enclosure theory; radiation exchange between solid bodies; radiation exchange in the presence of absorbing, transmitting, and emitting media; combined radiation, conduction, and convection exchange. *Preq:* ME 304 or equivalent, consent of instructor.
- ME 833 Heat Transfer with Change of Phase 3(3,0)** Nucleate boiling in a pool; film boiling in a pool; forced nucleate boiling; forced film boiling; effect of impurities on boiling phenomena; dropwise condensation; filmwise condensation; effect of non-condensable gases on condensation; boiling and condensing processes in systems. *Preq:* ME 304 or equivalent, consent of instructor.



**M E 834 Principles of Structural Stability 3(3,0)** Practical criteria for analysis of conservative and nonconservative systems' stability; methods of adjacent equilibrium, initial imperfections, total potential energy, and vibration as applied to practical problems. *Preq:* M E 837.

**M E 836 Fracture Mechanics 3(3,0)** Fundamental elasticity-based course in the development of the basic concepts of engineering fracture mechanics; the Griffith criterion, Barrenblatt and Dugdale models, linear elastic fracture mechanics (L.E.F.M.), plane strain fracture toughness, the crack-tip stress and strain field, and plasticity and the J-integral. *Preq:* M E 837.

**M E 837 Theory of Elasticity I 3(3,0)** Theory of stress and deformation for continuous media; linear stress-strain relations for elastic material; two-dimensional problems including Airy stress function, polynomial solutions, plane stress and plane strain in rectangular and polar coordinates, torsion and bending of prismatic bars and thermal stresses. *Preq:* M E 302, MTHSC 208.

**M E 838 Theory of Elasticity II 3(3,0)** Continuation of M E 837 including topics from either three-dimensional problems associated with an infinite elastic medium, elastic half-space, contact stresses, symmetrically loaded sphere and circular cylinder, or complex variable methods in plane elasticity, stress concentrations problems, singular stresses and fracture, and composite materials. *Preq:* M E 837, PHYS 812.

**M E 843 Nonlinear Dynamics of Mechanical Systems 3(3,0)** Behavior of nonlinear mechanical systems analyzed with numerical, graphical, and analytical methods; understanding nonlinear effects and methods of analysis. *Preq:* Graduate standing or consent of instructor.

**M E 844 Random Vibration: Theory and Measurement 3(3,0)** Analysis and measurement of random phenomena; description of random phenomena (probability theory, response of systems to random phenomena, and digital signal processing theory); use of spectrum analyzer and other digital signal recording instruments. *Preq:* M E 302 or MTHSC 208 and consent of instructor.

**M E 845 Vibration of Continuous Media 3(3,0)** Fundamental principles of generation, propagation, absorption, reflection, and scattering of vibrational wave in solids and fluids; free and forced oscillation of flexible strings, bars, membranes, and plates; theory of wave motion in liquids and gases. *Preq:* Consent of instructor.

**M E 846 Intermediate Dynamics 3(3,0)** Kinematics and dynamics of particles and rigid bodies, Lagrange and Hamilton's formulation of mechanics; two-body central force problem; rendezvous of two bodies in a central force field; rotation of rigid bodies about a fixed point in space; vector analysis and matrix methods as aids in mathematical analysis. *Preq:* E M 202 or consent of instructor.

**M E 852 Advanced Finite Element Analysis 3(3,0)** Application of variational and weighted residuals methods; nonlinear analysis, steady-state, and time-dependent problems; application of commercial finite element codes; advanced computational procedures. *Preq:* C E 808 or equivalent or consent of instructor.

**M E (E C E) 854 Analysis of Robotic Systems 3(3,0)** See E C E 854.

**M E (E C E) 859 Intelligent Robotic Systems 3(3,0)** See E C E 859.

**M E 861 Materials Selection in Engineering Design 3(3,0)** Advanced study of various physical, chemical, and mechanical materials properties which govern the selection of materials in engineering design. Case studies of materials selection in design with metals, ceramics, polymers, and composites are presented.

**M E 870 Advanced Design Methodologies 3(3,0)** Nurturing of creativity; decision-making processes for design; in-depth study of the mechanical design process and tools; quality function deployment, concurrent design, systemic design, robust design, design for assembly, and axiomatic design.

**M E 871 Engineering Optimization 3(3,0)** Optimization in the context of engineering design; nonlinear and linear, static and dynamic, constrained and unconstrained formulation and solution of practical problems; structural optimization; multi-objective optimization; genetic algorithms; simulated annealing.

**M E 891 Master's Thesis Research 1-12**

**M E 893 Selected Topics in Mechanical Engineering 1-6(1-6,0)** Topics not covered in other courses. May be repeated for credit.

**M E 930 Advanced Topics in Heat Transfer 1-6(1-6,0)** Topics not covered in other courses. May be repeated for a maximum of six credits.

**M E 931 Advanced Topics in Fluid Mechanics 3(3,0)** Topics not covered in other courses. May be repeated for a maximum of six credits.

**M E 932 Advanced Topics in Thermodynamics 3(3,0)** Topics not covered in other courses. May be repeated for a maximum of six credits.

**M E 991 Doctoral Dissertation Research 1-12**

## MICROBIOLOGY

**MICRO 600 Public Health Microbiology 3(3,0)** Epidemiology of transmissible diseases including pathogenic characteristics of the infectious organism, modes of transmission, mechanism of infection, diagnostic aids, effective treatments, immunizing procedures, and methods of preventing infection. *Preq:* MICRO 305.

**MICRO 601 Microbial Diversity and Ecology 4(2,6)** In-depth survey of microbial morphology, ecology, and diversity. Study of the interaction and adaptation of microbes in a wide range of environmental conditions, including consideration of their metabolism, nutrition, growth, and the use of microbiological assays. *Preq:* CH 201 or 223, 227, MICRO 305.

**MICRO 603 Marine Microbiology 3(2,3)** Discussion of the microbes that inhabit the marine environment, their peculiar physiological traits, and contributions to the ecology of oceans. *Preq:* MICRO 305, organic chemistry.

**MICRO 607 Food and Dairy Microbiology 4(3,3)** Physical-chemical factors limiting survival and growth of microorganisms during processing and manufacturing of food and dairy products. Standard methods for enumerating and identifying indicator bacteria, yeasts, molds, and microbes producing food and food-borne illness. Starter cultures, fungal toxins, microbial cell injury, and standards for food and dairy products. *Preq:* BIOCH 305 or CH 201 or 223, MICRO 305.

**MICRO 610 Soil Microbiology 3(2,3)** Role of microorganisms in the decomposition of organic substances, transformation of nitrogen, and mineral substances in the soil; interrelationships between higher plants and microorganisms; importance of microorganisms in soil fertility. *Preq:* MICRO 305.

**MICRO 611 Pathogenic Bacteriology 4(3,3)** Study of pathogenic bacteria, their morphology, cultural requirements, and classification; diagnostic tests, methods of differentiation, and the diseases caused. *Preq:* MICRO 305.

**MICRO 612 Bacterial Physiology 4(3,3)** Consideration of the cytology, physiology, metabolism, and genetics of bacteria including growth and death, reproduction and mutation, nutrition and metabolic pathways, regulatory mechanisms, and effects of environment. *Preq:* CH 224, MICRO 305, one semester of biochemistry, or consent of instructor.

**MICRO 613 Industrial Microbiology 3(2,3)** Microbial aspects of large-scale processes for the production of foods, antibiotics, enzymes, fine chemicals, and beverages. Topics include strain selection, culture maintenance, biosynthetic pathways, continuous cultivation, and production of single cell protein. *Preq:* MICRO 305.

**MICRO (AVS, BIOSC) 614 Basic Immunology 4(3,3)** Consideration of the nature, production, and function of basic immune responses in animals. Procedures and mechanisms of antigen-antibody and other immune reactions. *Preq:* MICRO 305, organic chemistry.

**MICRO 615 Microbial Genetics 4(3,3)** Cytological basis of bacterial, fungal, and viral genetics; molecular aspects; mutations; mechanisms of genetic transfers; episomes and plasmids; and population changes. *Preq:* BIOCH 301, CH 224, MICRO 305, or consent of instructor.

**MICRO 616 Introductory Virology 3(3,0)** General introduction to the field of virology including animal, bacterial, and plant viruses. Topics include nomenclature and classification, biochemical and biophysical characteristics, mechanisms of replication, chemotherapy, and techniques for isolation, assay, and purification. *Preq:* BIOCH 301, MICRO 305, or consent of instructor.

**MICRO 617 Molecular Mechanisms of Carcinogenesis and Aging 3(3,0)** Changes which occur at the cellular and subcellular levels during transformation and aging. Accumulated damage and "intrinsic clock" theories of aging; genetic and epigenetic theories of carcinogenesis; epidemiology of cancer; viral, radiation-induced, and chemical carcinogenesis; the immune system and cancer. *Preq:* BIOCH 301, MICRO 305, or consent of instructor.



**MICRO (BIOSC, GEN) 618 Biotechnology I: Nucleic Acids Techniques 4(2,4)** See GEN 618.

**MICRO 619 Selected Topics in Molecular Medicine 3(3,0)** Introduction to various areas of molecular medicine. Examines the latest research and developments in molecular medicine. Designed for students interested in medicine and biomedical research. May be repeated for a maximum of six credits. *Preq:* BIOCH 301, MICRO 305, or consent of instructor.

**MICRO 802 Bacteriological Techniques 4(2,6)** Analytical and experimental procedures used in bacteriology including techniques for studying bacterial cytology, physiology, and metabolism; experience in more advanced methods of investigation. Offered fall semester only.

**MICRO 803 Special Problems in Microbiology 1-3** Research not related to a thesis.

**MICRO 804 Selected Topics in Microbiology 1-3(1-3,0)** Evaluation of current research literature in various areas of microbiology. Critical evaluation of specific publications in terms of their scientific merit. Required of all Microbiology graduate students. May be repeated for credit.

**MICRO 805 Techniques of Clinical Microbiology and Immunobiology 3(2,3)** Methods for isolating, identifying, and culturing different mammalian cell types; techniques used to analyze cell function and viability and for protein and DNA analysis emphasizing application to the diagnosis of disease, determination of prognosis, optimization of treatment, and determination of etiology. *Preq:* MICRO (AVS, BIOSC) 614, 615, BIOCH 623 or equivalent, or consent of instructor.

**MICRO 806 Pathogenesis and Infectious Disease 3(3,0)** Medically important host-parasite relationships at the cellular and subcellular levels with emphasis on bacterial and viral infections in man. *Preq:* MICRO 611 or consent of instructor.

**MICRO 807 Seminar 1(1,0)** Topics not covered in other courses. Students review literature, organize, and present material. May be repeated for a maximum of two credits.

**MICRO 808 Biotechnology and Medicine 3(3,0)** Medical problems currently receiving attention due to the application of biotechnology to diagnosis or treatment. Basic information essential to understanding the molecular biology of the disease and its diagnosis or treatment. *Preq:* Consent of instructor.

**MICRO (HLTH) 809 Epidemiological Research 3(3,0)** Basic concepts of epidemiology with emphasis on applied aspects rather than theoretical. Examples are drawn from clinical practice. Use of relevant PC-based computer packages is required. *Preq:* MTHSC 405 or EX ST 801 or consent of instructor.

**MICRO 811 Bacterial Cytology and Physiology 4(4,0)** Structure, chemistry, and physiology of the various bacterial cell components. Physiology of bacterial growth and reproduction in batch, continuous, and synchronous cultures. Economy of the bacterial cell including endogenous metabolism and maintenance requirements; physiology of bacterial death; regulation of enzyme and nucleic acids syntheses. Offered spring semester of odd-numbered years only. *Preq:* BIOCH 423, MTHSC 206, or consent of instructor.

**MICRO 812 Bacterial Metabolism 3(3,0)** Various biochemical pathways occurring in bacterial cells; fermentations of carbohydrates and related compounds and of nitrogenous organic compounds; anaerobic and aerobic respiration including electron transport systems and oxidative phosphorylation; bacterial photosynthesis; nitrogen fixation; biosyntheses of amino acids, purines, pyrimidines, lipids, proteins, nucleic acids, and polysaccharides. Offered spring semester of even-numbered years only. *Preq:* BIOCH 423, MTHSC 206, or consent of instructor.

**MICRO 815 Advanced Microbial Genetics 3(3,0)** Current developments in microbial genetics; integration of genetics and biochemistry; analysis of genetic fine structure in microorganisms; nature of bacterial variation and expression of mutations; population dynamics; physicochemical mechanisms of heredity; regulation of gene action in microorganisms; physiology and genetics of virulent and lysogenic bacteriophages. Offered fall semester only. *Preq:* MICRO 415.

**MICRO 891 Master's Thesis Research 1-12**

**MICRO 991 Doctoral Dissertation Research 1-12**

## MUSIC

**MUSIC 600 Elementary Music in the Classroom 3(3,0)** Familiarizes teachers in the elementary classroom with traditional Kodaly, Orff, and Kindermusik approaches in correlating music with language arts, mathematics, and social studies.

**MUSIC 680 Audio Engineering II 3(2,2)** Advanced course in music technology focused on music production integrating digital audio and virtual instruments *Preq:* MUSIC 380 or consent of instructor.

**MUSIC 699 Independent Studies 1-3(1-3,0)** Tutorial work for students with special interests in music study outside the scope of existing courses. May be repeated for a maximum of six credits. *Preq:* Consent of department chair.

## NURSING

**NURS 801 Advanced Family and Community Nursing 3(3,0)** Developmental, psychodynamic, social-political, and cultural theories and concepts are synthesized and applied to the analysis of health and illness in communities and in families across the life cycle. Roles and functions of advanced practice nurses in promoting community health and family health are examined.

**NURS 804 Knowledge Development in Advanced Nursing 2(2,0)** Nursing theories and theories relevant to nursing practice and research; processes of theoretical thinking and critical thinking applied to health problems and needs of individuals and their families in the community; theoretical and conceptual models of contemporary practice and research.

**NURS 805 Pharmacotherapeutics for Advanced Nursing 3(3,0)** Prescription administration and patient/family education in use of pharmacological agents emphasizing drugs prescribed for common or chronic illnesses; drug selection; adverse drug reactions; age-related differences in utilization; regulations affecting nurses' prescriptive authority. *Preq:* NURS 809 or consent of instructor.

**NURS 806 Advanced Assessment for Nursing 2(1,3)** Comprehensive assessment and diagnosis of health problems and status for individuals of all ages including assessment of families; physical and laboratory/radiologic diagnostic assessments; directed laboratory experiences in advanced assessment of clients of several ages. *Preq:* Undergraduate assessment and NURS 809 or consent of instructor.

**NURS 807 Clinical Nursing Research 2(2,0)** Quantitative and qualitative research methodologies useful and appropriate to clinical nursing practice and for the development of nursing knowledge; ethics with human subjects; does not include thesis advisement. Student must select chairperson prior to enrollment. *Preq:* NURS 804, 808.

**NURS 808 Nursing Research Analysis 2(2,0)** Quantitative research methods in nursing science including basic elements of statistical design with a focus on the use of nursing informatics and computer applications. *Preq:* Undergraduate statistics course.

**NURS 809 Pathophysiology for Advanced Nursing 2(2,0)** Human response to health alterations as they impact nursing knowledge and practice; recognizing the manifestations of health alterations and developing nursing interventions accordingly.

**NURS 819 Developing Family Nursing 4(2,6)** Theories and concepts related to nursing management in the care of developing families; critical thinking applied to health problems and needs of developing families before, during, and immediately following pregnancy; application of related nursing issues and current research; clinical practice with developing families in a variety of settings. *Preq:* NURS 801, 804, 805, 806, 809.

**NURS 820 Child and Adolescent Nursing 4(2,6)** Advanced nursing roles and functions applied to health promotion, health maintenance, health restoration, habilitation, and rehabilitation of infants, children, and adolescents with existing or potential health problems. Critical thinking is used to assess, diagnose, intervene, and promote continuity of care with clients of these ages irrespective of setting. *Preq:* NURS 801, 804, 805, 806, 809.

**NURS 821 Adult Nursing 4(2,6)** Roles and functions embodied in advanced practice applied to the health promotion and clinical management of common or chronic health problems of adults within the context of family; clinical practice with adult clients in a variety of settings. *Preq:* NURS 801, 804, 805, 806, 809.

**NURS 822 Gerontology Nursing 4(2,6)** Roles and functions of advanced practice applied to the preventive, restorative, and rehabilitative care of the older adult with existing or potential health problems; clinical practice in a variety of settings. *Preq:* NURS 801, 804, 805, 806, 809.

**NURS 823 Nurse Practitioner Clinical Practicum 6(0,18)** Guided practice applying advanced nursing knowledge in family nursing and advanced practice roles (clinical nurse specialist, case manager, and/or practitioner); joint preceptor and faculty guidance and supervision in the care of selected populations in a variety of health care settings. *Preq:* FNP track: NURS 819, 820, 821, 822; GNP track: NURS 822, 882, 884; A/GNP track: NURS 821, 822, 882, 884.



**NURS 825 Theories and Models of Nursing Administration 3(3,0)** Identification, analysis, and synthesis of theories, models, and issues related to nursing management and leadership; organization, attitudes, and practices applicable to the middle and executive levels of nursing administration. *Preq:* NURS 804.

**NURS 826 Administration of Nursing Services 3(2,3)** Application of theories and models to specific nursing administration issues and problems. Practicum in nursing administration at the middle or executive level permits specific use and evaluation of a conceptual model of nursing administration. *Preq:* NURS 825.

**NURS 827 Foundations of Nursing Education 3(3,0)** Exploration of the foundations of nursing education. Emphasis is on curriculum development in nursing for the collegiate or continuing education areas. Current issues and research that influence nursing education. *Preq:* Graduate status in Nursing.

**NURS 828 The Nurse Educator 3(2,3)** Roles and functions of nurse educators applied to education of nurses and nursing students in collegiate and continuing education nursing education programs; current issues and research in classroom, laboratory, and continuing education programs. A teaching practicum is required. *Preq:* NURS 827 or consent of instructor.

**NURS 829 Theories and Models of Clinical Specialization 3(3,0)** Caregiver, researcher, manager, teacher, and consultant roles of the clinical nurse specialist in a variety of settings; theories, models, and health care issues underlying the role of clinical nurse specialist. *Preq:* NURS 804, CNS graduate option, or consent of instructor.

**NURS 830 Clinical Specialty Practicum in Nursing 6(0,18)** Advanced practice in a selected clinical specialty area in nursing that emphasizes application of the clinical specialist role. *Preq:* NURS 829 and one of the following: NURS 819, 820, 821, 822, 882, 884, or consent of instructor.

**NURS 831 Clinical Research Problems 1-3(1-3,0)** Critical thinking and methodologies of scientific inquiry applied to clinical issues/problems encountered in advanced nursing practice. May be repeated for a maximum of three credits. To be taken Pass/Fail basis. *Preq:* NURS 804.

**NURS 846 Healthcare Financial Management 3(3,0)** Financial management theory and practice for nurse executives; the state of financial reporting requirements and accounting practices for decision-making and operating activities; processes for measuring and reporting financial information and analysis; interpretation and use of accounting information for planning and controlling the health care business. *Preq:* Undergraduate accounting.

**NURS 847 Internship 3(1,6)** Guided practice to apply advanced nursing knowledge in nursing administration in the advanced practice role; joint preceptor and faculty guidance and supervision in the administrative management and care with selected populations in a variety of health care settings. *Preq:* NURS 825, 826, 846, or consent of instructor.

**NURS 848 Health Care Policy and Economics 3(3,0)** Reciprocal relationship between client, community, health care system, sociocultural, and economic variables and policy making; analysis and synthesis of these relationships and their impact on the role and responsibility of the advanced practice nurse and nurse administrator. *Preq:* Graduate standing or consent of instructor.

**NURS 850 Information and Control Systems for Nursing Leadership 3(3,0)** Computer-based systems of information management and control for nursing environments. Explores data needed for cost-efficient use of nursing resources and effective systems of monitoring, quality assurance, and control; information systems as tools useful to humanistic nursing practice, human resource management, and solution of professional and scientific problems. *Preq:* Graduate standing or consent of instructor.

**NURS 879 Special Topics in Nursing 1-3(1-3,0-9)** In-depth seminar on selected topics such as therapeutic communication, legal and ethical issues in nursing, and health care and political process in health. *Preq:* Consent of instructor.

**NURS 882 Primary Care for Elders 4(2,6)** Application of the roles and functions of advanced practice in the management of frailty in old age; prevention of early disability and dependence; maintenance of function, independence, and self care; cultural, social, and ethical issues. *Preq:* NURS 801, 804, 805, 806, 809.

**NURS 884 Mental Health and Illness of Adults 4(2,6)** Psychosocial, developmental, spiritual, and cultural theories are synthesized and applied to the analysis of mental health and illness in adulthood. Considers roles and functions of advanced practice nurses in promoting the mental health of adults and their families. Clinical practice in the community is incorporated. *Preq:* NURS 801, 804, 805, 806, 809.

**NURS 889 Special Problems in Nursing 1-6(1-6,0)** Problems selected to meet special and individualized interests of students. Up to six hours of NURS 889 may be taken as elective credit. *Preq:* Consent of instructor.

**NURS 891 Master's Thesis Research 1-12** Research activities related to thesis; minimum of six hours required. *Preq:* NURS 804.

## NUTRITION

**NUTR 601 Fundamentals of Nutrition 3(3,0)** Biochemical and physiological fundamentals of nutrition applicable to domestic animals and man. Digestive processes and absorption and metabolism of carbohydrates, lipids, proteins, water, minerals, and vitamins are considered. Energy metabolism and comparative anatomy and physiology of digestive systems are discussed. Offered fall semester only. *Preq:* BIOCH 305, CH 223, or consent of instructor.

**NUTR 624 Medical Nutrition Therapy I 4(3,3)** Principles of nutritional assessment, education, and counseling skills; development of medical nutrition therapy for individuals with obesity and eating disorders, gastrointestinal disorders, metabolic, and renal disorders. *Preq:* BIOSC 223, NUTR 451, or consent of instructor.

**NUTR 625 Medical Nutrition Therapy II 4(3,1)** Development of medical nutrition therapy for individuals with various disease states including cardiovascular, hepatic, musculoskeletal, and neoplastic disorders with consideration of sociocultural and ethnic aspects of food consumption and alternative nutrition therapies. *Preq:* BIOSC 223, NUTR 424, or consent of instructor.

**NUTR 626 Community Nutrition 3(3,0)** Study of fundamentals of nutrition care delivery in community programs beginning with assessment and problem identification and continuing through the development, implementation, and evaluation of nutrition intervention programs. *Preq:* NUTR 451 or equivalent or consent of instructor.

**NUTR 651 Human Nutrition 3(3,0)** Essentials of nutrition and principal nutritional deficiency conditions. Factors affecting adequacy of dietary intake, methods of determining nutritional status, development of nutrition standards, and recent advances in human nutrition. *Preq:* BIOCH 305/306 or equivalent or consent of instructor.

**NUTR 655 Nutrition and Metabolism 3(3,0)** Concepts of metabolism fundamental to understanding normal and therapeutic nutrition are examined. Bioenergetics as well as metabolism of carbohydrates, lipids, amino acids, vitamins, and minerals as they relate to nutrition are discussed. *Preq:* BIOCH 305 or 406 or 423, NUTR 451, or consent of instructor.

**NUTR 706 Nutrition for Teachers 3(3,0)** Principles of nutrition applied to nutrition education. *Preq:* Consent of instructor.

**NUTR 801 Topical Problems in Nutrition 1-3(1-3,0)** Topics not covered in other courses or by thesis research. Credit varies with problems selected.

**NUTR 802 Special Topics in Nutrition 1-3(1-3,0)** Topics of special interest or contemporary subjects not examined in other courses.

**NUTR 803 Advanced Human Nutrition 4(4,0)** Biochemistry and physiology related to human nutrition and their application to formation and adoption of healthy eating patterns. Emphasis is on individual nutrients in the context of healthy eating patterns throughout the life cycle and on recent advances in human nutrition. *Preq:* BIOCH 305/306, BIOSC 223, NUTR 451, or consent of instructor.

**NUTR 804 Nutrition Education of the Public 3(3,0)** Analysis of community-based food and nutrition programs to include management, program provision, outcome-based evaluation, and integration of services. Emphasis is on outcome-based nutrition education across the lifespan, management and integration of multiple services for targeted population, and public policy development. *Preq:* NUTR 426 or consent of instructor.

**NUTR 805 Metabolic Basis of Medical Nutrition Therapy 3(3,0)** Integration of metabolism and pathophysiology into medical nutrition therapy recommendations. *Preq:* NUTR 425 or consent of instructor.

**NUTR 806 Dietetic Internship 1-6(0,3-18)** Internship consisting of preceptor-supervised and faculty-led dietetic experiences in community, clinical, and food service settings. Must be taken for six credits during the internship rotations. *Preq:* Acceptance into Dietetic Internship Program.



**NUTR 808 Monogastric Nutrition 3(3,0)** Basic concepts and current research related to nutrient requirement and metabolism of poultry, swine, and other monogastric species. *Preq:* NUTR 401 or 451.

**NUTR 809 Ruminant Nutrition 3(3,0)** Microbiological, biochemical, and physiological processes involved in the synthesis of amino acids, proteins, and B-vitamins; relation of these processes to utilization of proteins, lipids, and fibrous and nonfibrous feed ingredients; properties and functions of nutrients, nonprotein nitrogen compounds, and growth-promoting substances for dairy cattle, beef cattle, and sheep. *Preq:* NUTR 401 or consent of instructor.

**NUTR 811 Carbohydrate Nutrition 2(2,0)** Dietary sources, chemistry, absorption/excretion, and functions of carbohydrates; the aberrations of metabolism and possible role in the etiology of degenerative diseases. *Preq:* BIOCH 623 or equivalent; NUTR 601 or 651 or equivalent; or consent of instructor.

**NUTR 817 Mineral Nutrition 2(2,0)** Occurrence, chemistry, absorption/excretion, and general and specific physiological functions of minerals. *Preq:* BIOCH 623 or equivalent; NUTR 601 or 651 or equivalent; or consent of instructor.

**NUTR 819 Vitamin Nutrition 2(2,0)** Overview of the chemistry, metabolism, physiology, digestion, absorption, and excretion of the vitamins as applied to the nutrition of humans and domestic animals. *Preq:* BIOCH 623 or equivalent; NUTR 601 or 651 or equivalent; or consent of instructor.

**NUTR 820 Nutritional Bioenergetics 2(2,0)** Quantitative approach to the losses of dietary energy during digestion and metabolism; factors governing the energetic efficiency of different biological functions in animals and man; regulation of energy balance; body temperature regulation; techniques of calorimetry. *Preq:* BIOCH 623 or equivalent; NUTR 601 or 651 or equivalent; or consent of instructor.

**NUTR 851 Nutrition Seminar I 1(1,0)** Current research and developments in nutrition. Topics, selected by the instructor and students, come from student research and nutrition literature. Offered fall semester only.

**NUTR 852 Nutrition Seminar II 1(1,0)** Continuation of NUTR 851. Offered spring semester only.

**NUTR 891 Master's Thesis Research 1-12**

**NUTR 991 Doctoral Dissertation Research 1-12**

## PACKAGING SCIENCE

**PKGSC 601 Packaging Machinery 3(3,0)** Systematic study of machinery used to form, fill, seal, laminate, combine, and print continuous and automated packaging lines and auxiliary material handling equipment, including principles of machine design, operation, selection, and specification. *Preq:* PKGSC 204, PHYS 207, or consent of instructor.

**PKGSC 604 Mechanical Properties of Packages and Principles of Package Evaluation 3(3,0)** Study of the mechanical properties of packages and principles and standard methods (ASTM, TAPPI) of determining these properties. Evaluation of functional properties of packages including shock and vibration isolation. *Preq:* PHYS 207, PKGSC 204, or consent of instructor.

**PKGSC 616 Application of Polymers in Packaging 4(3,3)** Detailed study of polymer chemistry and polymerization technology. Emphasis is on polymers which are significant in packaging. Study includes polymer morphology, rheology, physical properties, and processing methods. *Preq:* PKGSC 204, 206; CH 201 or 223; PHYS 207; or consent of instructor.

**PKGSC 620 Package Design and Development 3(2,3)** Study of principles and methods practiced in designing and developing packages and packaging systems and of methods used to coordinate and analyze package development activities including interfacing with product development, manufacturing, marketing, purchasing, and accounting. *Preq:* PKGSC 368, 401, 404, 416, 464, or consent of instructor; second semester senior standing.

**PKGSC 630 Converting for Flexible Packaging 3(1,6)** Study of materials, methods, processes, and equipment used in converting web materials for flexible packaging. Laboratory provides hands-on experience preparing and operating pilot-scale converting equipment. *Preq:* PKGSC 204, 206; or consent of instructor.

**PKGSC 640 Packaging for Distribution 3(3,0)** Delivery of a packaged product from point of manufacture to point of sale often involves several shipping methods, e.g., truck, rail, air, or ship. To assure both product protection and lowest cost, students must be familiar with the fundamentals of distribution packaging technology. *Preq:* Senior standing, consent of instructor.

**PKGSC 654 Package Evaluation Laboratory 2(0,6)** Laboratory experiments to determine properties of packaging materials and to evaluate the performance of packages including shipping tests (shock and vibration). Students learn how to operate standard testing apparatus and become familiar with industry-recognized test methods and standards. *Preq:* PKGSC 404 or consent of instructor.

**PKGSC 664 Food and Health Care Packaging Systems 4(3,3)** Characteristics, engineering properties, and applications of various materials and systems used in the packaging of foods, pharmaceuticals, and medical devices. Packaging systems for specific food and medical applications are considered. Laboratory and field exercises on food and medical packaging operations and packaging materials are included. Emphasis is on evaluation methods. *Preq:* PKGSC 201, 204, 206, or consent of instructor.

**PKGSC 671 Wood and Paper Packaging 3(3,0)** In-depth study of use of wood and paper in packaging. Covers characterization of raw materials, basic conversion processes, and the use of converted products in packaging. Emphasizes the relationship between structure, processing, and properties. *Preq:* PKGSC 102 or consent of instructor.

**PKGSC 802 International Packaging 3(3,0)** International packaging, including material, practices, machinery, marketing, and regulatory compliance principles. *Preq:* Consent of instructor.

**PKGSC 804 Flexible Packaging 3(2,3)** In-depth study of flexible, plastic-containing primary packages and the methods and materials used to manufacture them. Six representative packages are selected for discussion using a case-study approach. Guest lecturers and plant visits are used to illustrate and amplify the primary instructional materials. *Preq:* PKGSC 416 and 471 or consent of instructor.

**PKGSC 806 Semi-Rigid Packaging 3(2,3)** Semi-rigid and rigid plastic-containing primary packages and containers and the methods and materials used to manufacture them. Six representative packages are selected for discussion using a case-study approach. Guest lectures and plant visits are used to amplify and illustrate the primary instructional materials. *Preq:* PKGSC 416 and 471 or consent of instructor.

**PKGSC 821 Selected Problems 1-4(0,1-12)** Independent research investigations in packaging science related to packaging materials, machinery, design, and applications in areas not covered in other courses. May be repeated for credit. *Preq:* Consent of instructor.

**PKGSC 822 Selected Topics 1-4(1-4,0)** Selected topics in packaging science not covered in detail or contained in other courses. May be repeated for credit. *Preq:* Consent of instructor.

**PKGSC 851 Packaging Science Seminar 1(1,0)** Current research and related developments in packaging science reviewed by faculty, students, and invited lecturers. May be repeated for a maximum of four credits. *Preq:* Consent of instructor.

**PKGSC 891 Master's Thesis Research 1-9** Research on a master's thesis topic.

## PARKS, RECREATION, AND TOURISM MANAGEMENT

**PRTM 612 Therapeutic Recreation and Mental Health 3(3,0)** Therapeutic recreation services in mental health clinics, institutions, and outdoor settings. Review of disorders and current modes of treatment as they relate to therapeutic recreation. *Preq:* PRTM 311, 2.0 cumulative grade-point ratio, consent of instructor.

**PRTM 613 Recreation Therapy in Physical Rehabilitation 3(3,0)** Examination of the characteristics of chronic disabilities and their implications to the individual and to the planning and directing of recreation therapy services. *Preq:* PRTM 311, three credit hours of human anatomy and physiology, 2.0 cumulative grade-point ratio, consent of instructor.

**PRTM (ED SP) 614 Recreation and Leisure for Special Populations 3(3,0)** Provides class participants with practical experience in designing recreation and leisure activities for special populations (e.g., handicapped, elderly). *Preq:* 2.0 cumulative grade-point ratio.

**PRTM 621 Recreation Financial Resources Management 3(3,0)** Analysis of recreation financial resources management. Deals with revenue sources and their allocation. *Preq:* PRTM 321, Senior standing in Parks, Recreation, and Tourism Management, 2.0 cumulative grade-point ratio.



**PRTM (GEOG) 630 World Geography of Parks and Equivalent Reserves 3(3,0)** Major international patterns in the provision and use of urban and rural parks and recreation are examined. *Preq:* 2.0 cumulative grade-point ratio.

**PRTM 631 Methods of Environmental Interpretation 3(2,3)** Practice and instruction in the use of equipment and methods available to the interpreter in public contact work. Coaching in presentation and evaluation of live programs and in design, execution, and evaluation of mediated programs is the major emphasis. Programs are delivered to public audiences in the Clemson area. *Preq:* PRTM 330; Senior standing in Parks, Recreation, and Tourism Management; 2.0 cumulative grade-point ratio; consent of instructor.

**PRTM 641 Commercial Recreation 3(3,0)** Components of offering leisure services and products to the public by individuals, partnerships, and corporations for the purpose of making a profit. *Preq:* 2.0 cumulative grade-point ratio.

**PRTM 643 Resorts in National and International Tourism 3(3,0)** A variety of resort types are studied with respect to their development, organization, visitor characteristics, and environmental consequences. A case-study approach is used. *Preq:* 2.0 cumulative grade-point ratio.

**PRTM 644 Tour Planning and Operations 3(3,0)** Provides the opportunity to understand the psychology of touring with emphasis on packaged and group tours and how tours of different types and scale are planned, organized, marketed, and operated. *Preq:* PRTM 342, 2.0 cumulative grade-point ratio, consent of instructor.

**PRTM 645 Conference/Convention Planning and Management 3(3,0)** Provides the opportunity to understand the problems of and solutions to conference and convention planning and management from both the sponsoring organization's and facility manager's perspectives. *Preq:* 2.0 cumulative grade-point ratio.

**PRTM 646 Community Tourism Development 3(3,0)** Provides a community-based perspective of the organizational, planning, development, and operational needs for a successful tourism economy at the local level. *Preq:* PRTM 342, 2.0 cumulative grade-point ratio, consent of instructor.

**PRTM 647 Perspectives on International Travel 3(3,0)** Using the United States as a destination, international travel patterns and major attractions are presented. Factors that restrain foreign travel to the United States are analyzed. *Preq:* 2.0 cumulative grade-point ratio.

**PRTM 652 Campus Recreation 3(3,0)** Study of the basic components required for administration of successful college union and intramural-recreation sport programs. *Preq:* 2.0 cumulative grade-point ratio.

**PRTM 705 Internship 1-3** Field placement in an approved agency under qualified supervision. To be taken Pass/Fail only. *Preq:* PRTM major or consent of instructor.

**PRTM 708 Independent Study 1-3(1-3,0)** Topics in recreation, leisure, and tourism not covered in other courses. Written report of findings is required. May be repeated for a maximum of three credits. *Preq:* Consent of supervising faculty prior to registration.

**PRTM 709 Special Problems 1-3(1-3,0)** Directed, individual comprehensive investigation of a special problem to use knowledge gained in formal courses, provide experience and training in research, and prepare for professional goals. Report of findings is required. May be repeated with a maximum of three credits applied toward graduation requirements. To be taken Pass/Fail only.

**PRTM 801 Philosophical Foundations of Recreation and Park Administration 3(3,0)** Current theories and philosophies in recreation as they are influenced by and have influence on leisure and the changing environment in America. Students develop their own professional philosophies of recreation and leisure.

**PRTM 802 Group Processes in Leisure Services 3(3,0)** Improvement in human relations skills; knowledge of interpersonal needs and problems of individuals and groups. Students gain understanding of how others affect them and how they affect others and become more effective professional recreators, park administrators, supervisors, interpreters, and educators.

**PRTM 803 Seminar in Recreation and Park Administration 3(3,0)** Case problems relating to administration of a park, recreation, or tourism agency.

**PRTM 807 Recreation Behavior in Natural Environments 3(3,0)** Social, psychological, and environmental influences on human behavior; identification of theoretical perspectives to explain behavior and to resolve problems in recreation resource management.

**PRTM 808 Behavioral Aspects of Parks, Recreation, and Tourism Management 3(3,0)** Behavioral aspects of recreation, focusing on the social and psychological dimensions of the recreation experience in a variety of environments and activities.

**PRTM 811 Research Methods in Parks, Recreation, and Tourism Management 3(3,0)** Principles, methods, and strategies for planning, designing, evaluating, and applying studies of recreation. *Preq:* Graduate-level statistics course or consent of instructor.

**PRTM 812 Leisure Services for the Elderly 3(3,0)** The elderly and the role of leisure services in later life; needs of community-based and institutionalized elderly; service delivery systems to meet these needs.

**PRTM 815 Therapeutic Recreation and Activity Therapy Administration 3(3,0)** Service delivery structures; interdisciplinary relationships; consultation methods; in-service training; funding sources; service evaluation in therapeutic recreation and activity therapy programs.

**PRTM (FOR) 816 Remote Sensing and GIS in Natural Resources 3(2,3)** See FOR 816.

**PRTM 820 Recreation Resource Policy Issues and Processes 3(3,0)** Outdoor recreation policy-formation structures and processes are surveyed through case studies involving past and current public policy issues.

**PRTM 840 Tourism Planning 3(3,0)** Tourism planning procedures and techniques; planning process and associated concerns such as market, facility, infrastructure, environment, culture, and economics.

**PRTM 843 Tourism Analysis 3(3,0)** Selected theories, methods, techniques, practices, and principles that govern tourism behavior. *Preq:* Graduate standing or one graduate-level statistics course or consent of instructor.

**PRTM (C R P) 844 Outdoor Recreation Resource Management and Planning 3(3,0)** See C R P 844.

**PRTM 891 Master's Thesis Research 1-12**

**PRTM 900 Selected Topics 1-3(1-3,0)** In-depth, timely study of trends or problems in parks, recreation, and tourism not covered in other courses. May be repeated for a maximum of six credits.

**PRTM 908 Advanced Topics 1-3(1-3,0)** Topics not covered in other PRTM courses and not directly related to a thesis or dissertation topic. Formal paper is required. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.

**PRTM 910 Research Seminar 1(1,0)** Current research developments in PRTM and presentation of research projects. May be taken for credit for two semesters. To be taken Pass/Fail only.

**PRTM 911 Professional Issues in Parks, Recreation, and Tourism Management 1(1,0)** Multidisciplinary perspectives to examine concepts and methods related to professional development of parks, recreation, and tourism management graduate students. *Preq:* Admission to PRTM graduate program or consent of instructor.

**PRTM 991 Doctoral Dissertation Research 1-12**

## PHILOSOPHY

**PHIL 601 Studies in the History of Philosophy 3(3,0)** In-depth study of a selected philosopher, philosophical school, or movement. Topics vary. With departmental consent, may be repeated once for credit. Current topics and course descriptions are available in the department's course offering brochure. *Preq:* Consent of instructor.

**PHIL 602 Topics in Philosophy 3(3,0)** Thorough examination of a particular philosophical topic, issue, or problem. Topics vary. May be repeated once for credit with departmental consent. Current topics and course descriptions are available in the department's course offering brochure. *Preq:* Consent of instructor.

**PHIL 606 Continental Philosophy for Architects 3(3,0)** Examines contemporary Continental philosophy over the course of the 20<sup>th</sup> century, with the goal of offering the proper theoretical background to Architecture students who use such theory in their studies and design work.

**PHIL 625 Philosophy of Psychology 3(3,0)** Detailed examination of psychology as an autonomous science. Issues include explanation in psychology and cognitive neuroscience, psychology naturalized as a "special science" comparable to biology and geology, evolutionary psychology, philosophy and psychopathology, and moral issues in psychology. *Preq:* Nine hours of psychology or consent of instructor.

**PHIL (A A H) 633 Issues in Contemporary Art and Philosophy 3(3,0)** Examines the intersections between recent developments in art and those in philosophy and critical theory. Course content varies, for example, Postmodernism in Art and Philosophy, Themes of Resistance in Contemporary Culture.



**PHIL 685 Topics in Philosophy of Biology 3(3,0)** Detailed analysis of a selected topic in philosophy of biology/theoretical biology. Topics may include the levels of selection debate, sociobiology, genetic explanation and genetic causation, the species question, and the history and sociology of biology. *Preq:* Eight hours of biology or consent of instructor.

**PHIL 845 Aesthetics 3(3,0)** Nature and value of aesthetic experiences and objects. Attention is directed to the roles of and relationships among objects, makers, and audiences; interpretation, criticism, and aesthetic response; the contexts and languages of art; the nature of aesthetic value; aesthetics in application; issues in public policy.

## PHYSICS

**PHYS 617 Introduction to Biophysics I 3(3,0)** Introduction to the application of physics to biological problems. Topics include elementary chemical and biological principles, physics of biological molecules, and fundamentals of radiation biophysics. *Preq:* MTHSC 206, PHYS 221, or consent of instructor.

**PHYS 620 Atmospheric Physics 3(3,0)** Study of physical processes governing atmospheric phenomena. Topics include thermodynamics of dry and moist air, solar and terrestrial radiative processes, convection and cloud physics, precipitation processes, hydrodynamic equations of motion and large-scale motion of the atmosphere, numerical weather prediction, atmospheric electricity. *Preq:* MTHSC 108, PHYS 208 or 221.

**PHYS 621 Mechanics I 3(3,0)** Statics, motions of particles and rigid bodies, vibratory motion, gravitation, properties of matter, flow of fluids. *Preq:* PHYS 221.

**PHYS 622 Mechanics II 3(3,0)** Dynamics of particles and rigid bodies, Lagrangian and Hamiltonian formulations, vibrations of strings, wave propagation. *Preq:* PHYS 321 or consent of instructor.

**PHYS 625 Experimental Physics I 3(1,4)** Introduction to experimental modern physics, measurement of fundamental constants, repetition of crucial experiments of modern physics (Stern-Gerlach, Zeeman effect, photoelectric effect, etc.). *Coreq:* PHYS 321 or consent of instructor.

**PHYS 626 Experimental Physics II 3(1,4)** Continuation of PHYS 325.

**PHYS 632 Optics 3(3,0)** Covers a selection of topics, depending on the interest of the student. Topics may include the formation of images by lenses and mirrors, design of optical instruments, electromagnetic wave propagation, interference, diffraction, optical activity, lasers, and holography. *Preq:* PHYS 221.

**PHYS 641 Electromagnetics I 3(3,0)** Study of the foundations of electromagnetic theory. Topics include electric fields, electric potential, dielectrics, electric circuits, solution of electrostatic boundary-value problems, magnetic fields, and magnetostatics. *Preq:* MTHSC 208 and PHYS 221, or consent of instructor.

**PHYS 642 Electromagnetics II 3(3,0)** Continuation of PHYS 441. Study of foundations of electromagnetic theory. Topics include magnetic properties of matter, microscopic theory of magnetization, electromagnetic induction, magnetic energy, AC circuits, Maxwell's equations, and propagation of electromagnetic waves. Other topics may include waves in bounded media, antennas, electrodynamics, special theory of relativity, and plasma physics. *Preq:* PHYS 441 or consent of instructor.

**PHYS 646 Solid State Physics II 3(3,0)** Continuation of PHYS 645, including selected topics in solid-state physics such as optical properties, superconductivity, noncrystalline solids, dielectrics, ferroelectrics, and nanomaterials. Plasmons, polarons, and excitons are discussed. Brief introduction into methods of solid-state synthesis and characterization tools is presented. *Preq:* PHYS 445 or consent of instructor.

**PHYS 652 Nuclear and Particle Physics 3(3,0)** Study of our present knowledge concerning subatomic matter. Experimental results are stressed. Topics include particle spectra, detection techniques, Regge pole analysis, quark models, proton structure, nuclear structure, scattering, and reactions.

**PHYS 655 Quantum Physics I 3(3,0)** Discussion of solution of the Schrodinger equation for free particles, the hydrogen atom, and the harmonic oscillator. *Preq:* PHYS 322 and 441 or consent of instructor.

**PHYS 656 Quantum Physics II 3(3,0)** Continuation of PHYS 455. Application of principles of quantum mechanics as developed in PHYS 455 to atomic, molecular, solid state, and nuclear systems. *Preq:* PHYS 455.

**PHYS 665 Thermodynamics and Statistical Mechanics 3(3,0)** Study of temperature development of the laws of thermodynamics and their application to thermodynamic systems. Introduction to low temperature physics is given. *Preq:* Six hours of physics beyond PHYS 222 or consent of instructor.

**PHYS 811 Methods of Theoretical Physics I 3(3,0)** Analytical methods and techniques used in theoretical physics: vector and tensor analysis as applied to physical problems, use of matrices and groups in classical and quantum mechanics, complex variables, and partial differential equations of physics.

**PHYS 812 Methods of Theoretical Physics II 3(3,0)** Continuation of PHYS 811. Use of integral transforms, integral equations, special functions, calculus of variations, and numerical approximations in solutions of physical problems.

**PHYS (M E) 815 Statistical Thermodynamics I 3(3,0)** Fundamental principles of kinetic theory and quantum statistical mechanics; Boltzmann statistics, Fermi-Dirac statistics, and Bose-Einstein statistics. *Preq:* A course in thermodynamics or consent of instructor

**PHYS 816 Statistical Thermodynamics II 3(3,0)** Generalized ensemble theory and fluctuations; applications to solids, liquids, gases, and blackbody radiation. *Preq:* PHYS (M E) 815.

**PHYS 821 Classical Mechanics I 3(3,0)** Dynamics of particles; variational principles and Lagrange's equations; two-body central force problems; dynamics of rigid bodies; matrix formulations freely used.

**PHYS 822 Classical Mechanics II 3(3,0)** Special relativity in classical mechanics; Hamilton's equations; canonical transformations; Hamilton-Jacobi theory; small oscillations.

**PHYS 841 Electrodynamics I 3(3,0)** Field theory of electromagnetism; Maxwell's equations and their application to study of electromagnetic wave production and propagation; wave optics and theories of interference and diffraction.

**PHYS 842 Electrodynamics II 3(3,0)** Production and propagation of electromagnetic waves beginning with use of Maxwell's equations; wave guides; diffraction phenomenon; boundary effects; theory of electrons and microscopic phenomena.

**PHYS 845 Solid State Physics I 3(3,0)** Physical properties of crystalline solids; crystalline state determination by diffraction methods; theories of specific heat; properties of metallic lattices and alloys; lattice energy and ferroelectrics.

**PHYS 846 Solid State Physics II 3(3,0)** Continuation of PHYS 845. Electronic properties of solids, band theory of solids, physics of semiconductors, theories of magnetism, and magnetic resonance phenomena.

**PHYS 852 Radiation Physics 3(3,0)** Interactions and basic mechanisms involved in the natural radiation environments of space, which include a variety of energetic, charged particles with sufficient energy to penetrate heavily shielded spacecraft and pose potential hazards to astronauts and electronic systems. *Preq:* Undergraduate degree in Physics or Electrical Engineering or consent of instructor.

**PHYS 875 Selected Topics 1-3(1-3,0)** Students and interested faculty study areas of physics currently being extensively investigated. May be repeated for credit, but only if different topics are covered.

**PHYS 890 Directed Activities in Applied Physics 1-6** Training and work on practical problems are supervised by department faculty or by appropriate adjunct professor. Written description of student's activities must be submitted to course supervisor at completion of activity. Maximum credit limits are six credit hours in a semester and three credit hours in a single summer session. To be taken Pass/Fail only.

**PHYS 891 Master's Thesis Research 1-12**

**PHYS 951 Quantum Mechanics I 3(3,0)** Review of wave mechanics, operator algebra and theory of representation, approximate methods for stationary problems, theory of scattering applied to atomic and nuclear problems.

**PHYS 952 Quantum Mechanics II 3(3,0)** Continuation of PHYS 951. Time-dependent perturbations, radiation, absorption and emission, relativistic quantum mechanics, introduction to quantum electrodynamics.



**PHYS 966 Relativity 3(3,0)** Special and general theory of relativity including tensor calculus, Lorentz transformation and three experimental tests of general theory: planetary motion and advance of perihelion of Mercury, bending of light rays in gravitational fields, and gravitational shift of spectral lines.

**PHYS 991 Doctoral Dissertation Research 1-12**

## PLANT AND ENVIRONMENTAL SCIENCES

**PES 825 Seminar 1(1,0)** Special topics and original research in plant and environmental sciences. To be taken Pass/Fail only.

**PES 826 Scientific Writing 1(1,0)** Written communication in the plant sciences. To be taken Pass/Fail only.

**PES (CSENV) 850 Agricultural Biotechnology 2(2,0)** See CSENV 850.

**PES 891 Master's Thesis Research 1-18**

**PES 991 Doctoral Dissertation Research 1-18**

## PLANT PATHOLOGY

**PL PA (ENT) 606 Diseases and Insects of Turfgrasses 3(2,2)** Host-parasite relationships, symptomatology, diagnosis, economics, and control of infectious and noninfectious diseases of turfgrasses; life histories, diagnosis, and control of important insect pests of turfgrasses. Offered fall semester only. *Preq:* ENT 301 and PL PA 310 or equivalents.

**PL PA 611 Plant Disease Diagnosis I 2(1,2)** Methods and procedures used in the diagnosis of plant diseases, especially late spring and early summer diseases. Basic techniques of pure culture and identification of plant pathogens and Koch's postulates are taught. Diagnosis of a wide variety of diseases of cultivated and wild plants is carried out. Offered summer session only. *Preq:* PL PA 310 or equivalent.

**PL PA 802 Selected Topics 1-3(1-3,0-6)** Current advances in phytopathology and physiology, diseases of specific crops and specialized laboratory protocol. May be repeated for credit. *Preq:* Consent of instructor.

**PL PA 804 Plant-Microbe Interactions 3(3,0)** Physiology, biochemistry, and genetics of plant-microbe interactions; molecular mechanisms involved in plant-microbe communication, plant colonization, and penetration; development of the microbe within the plant; induction of plant defense responses. Offered fall semester of even-numbered years only. *Preq:* BIOSC 401 and 402 or PL PA 310 or consent of instructor.

**PL PA 805 Special Problems in Plant Pathology 1-12** Research not related to a thesis. *Preq:* PL PA 411 or equivalent and consent of instructor.

**PL PA 807 Seminar 1(1,0)** Areas of plant pathology and plant physiology not covered by formal courses. Relevant literature is reviewed. Material is organized and presented by students. To be taken Pass/Fail only.

**PL PA 809 Analytical Techniques in Plant Science 3(2,3)** Theory of and practice in current techniques of separation science; hands-on experience with extraction, isolation, and characterization of chemical compounds associated with plants and microorganisms using techniques such as thin layer chromatography, gas chromatography, mass spectroscopy, high pressure liquid chromatography, and electrophoresis. *Preq:* Organic chemistry, general biochemistry, or consent of instructor.

**PL PA 810 Fungal and Bacterial Plant Pathogens 4(3,3)** Biology and molecular biology of plant pathogenic fungi and bacteria; principles of taxonomy, evolution, morphological structures, life cycles, population biology, ecology, control, and genetic manipulation of representative fungal and bacterial pathogens encountered by plant pathologists. *Preq:* PL PA 310, MICRO 305 or equivalent.

**PL PA 811 Plant Viruses and Plant Parasitic Nematodes 4(3,3)** Biology and molecular biology of plant viruses and plant-parasitic nematodes; taxonomy, evolution, life cycles, population biology, ecology, control, and genetic manipulation of representative viruses and plant-parasitic nematodes encountered by plant pathologists. *Preq:* PL PA 310 or equivalent.

## POLICY STUDIES

**PO ST 810 Political Economy 3(3,0)** Exploration of how public policy can be analyzed within a common framework that considers the objectives and constraints imposed on individuals in political and economic situations, decision rules consistent with these objectives and constraints, and the likely outcomes of various policy objectives. *Preq:* ECON (AP EC) 820 or consent of instructor.

**PO ST 822 Policy Analysis and Political Choice 3(3,0)** Opportunities and constraints in political systems; political feasibility and policy strategy assessment. Topics include role of power, ideas, organizational interaction, cognitive processes, interest groups, policy analysis, media, and random opportunity in determining policy outcomes. *Preq:* Admission to Policy Studies program or consent of instructor.

**PO ST 842 Ethics and Public Policy 3(3,0)** Exploration of the ethical dimensions of policy by examining moral and ethical issues raised by problem solving and decision making. Evaluation procedures integrating ethical dimensions into policy assessment. Topics include model codes of ethics for public officials and comparable standards for privately employed policy professionals. *Preq:* Admission to certificate or PhD program in Policy Studies or consent of instructor.

**PO ST 843 Organization Theory and Public Management 3(3,0)** Theoretical and analytical foundations for understanding bureaucracies and leadership roles in public management; clarification of the distinctly "public" dimensions and challenges of management. Interdisciplinary in nature, course draws on business and public administration, social psychology, economics, political science, and sociology. *Preq:* Admission to certificate or PhD program in Policy Studies or consent of instructor.

**PO ST 851 Rural Sustainable Development: Evolution of Public Policy 3(3,0)** Formulation of current national and local public policies that impact rural community development; the constraints and opportunities they provide; interaction among government institutions, decision makers, and interest groups; associated influence on rural sustainability. *Preq:* Admission to certificate or PhD program in Policy Studies or consent of instructor.

**PO ST 861 Space Policy 3(3,0)** Space science technology, civilian and military government programs, and private-sector activities. Case studies of long-term space policy issues impacting remote sensing, communications, and manned space stations. Examination of origins of programs and evolution of associated policy issues from a national and international perspective. *Preq:* Admission to certificate or PhD program in Policy Studies or consent of instructor.

**PO ST (C R P) 870 Seminar in Sustainable Development 3(3,0)** Concept of sustainable development traced from its historical roots through the popularization of the term in the international development literature; scientific base and the application of sustainability through economic sectors and building practice. Students conduct individual/group research projects.

**PO ST 890 Directed Study in Public Policy 3(3,0)** Students pursue readings and research in individual public policy topics under the direction of a Policy Studies faculty member. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**PO ST 893 Internship in Policy Analysis 3(3,0)** Twelve-week supervised internship with an approved public or private entity focusing on policy analysis. Monthly reports by student and agency are required. To be taken Pass/Fail only. *Preq:* Two semesters of coursework in Policy Studies program.

**PO ST 898 Policy Analysis Workshop 3(0,6)** Provides experience with contemporary policy issues. Students work in small groups with clients compiling information, developing policy options, and conducting analysis to address a policy issue. White paper is prepared analyzing policy options and making recommendations to policy makers. Typically taken in fourth semester. *Preq:* Three semesters of coursework in Policy Studies program.

**PO ST 899 Selected Topics in Policy Studies 3(3,0)** Intensive investigation of selected current and emerging public policy issues emphasizing current literature and results of current research. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**PO ST 904 Policy Analysis Seminar I 2(2,0)** Seminar module focusing on research methodology with readings and discussion. *Preq:* Three semesters of coursework in Policy Studies program.

**PO ST 905 Policy Analysis Seminar II 1(1,0)** Seminar involving student research with articles prepared for a professional audience and presented as part of the seminar. *Preq:* PO ST 904, three semesters of coursework in Policy Studies program.

**PO ST 991 Doctoral Dissertation Research 1-18**



## POLITICAL SCIENCE

**PO SC 609 Directed Study in American Politics 1-3(1-3,0)** Supervised reading and/or research in selected areas of American government. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.

**PO SC 616 Interest Groups and Social Movements 3(3,0)** Empirical and normative examination of the origins, roles, and influence of interest groups and social movements in the United States and of the relationships among interest groups, social movements, and democratic theory. *Preq:* PO SC 101, Junior standing, or consent of instructor.

**PO SC 621 Public Policy 3(3,0)** Introduction to the major approaches to public policy making in American government. Topics include theories and models of policy making, the identification of policy problems, agenda setting, the formulation and adoption of policy, implementation, and program evaluation. *Preq:* PO SC 101, Junior standing, or consent of instructor.

**PO SC 623 Urban Politics 3(3,0)** Examines the nature and scope of politics in urban communities and offers an analysis of urban governance, especially in the interaction of public authority and private institutions in metropolitan areas. Emphasis is on the structure, processes, and problems challenging governments in urban America. *Preq:* PO SC 101, Junior standing, or consent of instructor.

**PO SC 624 Federalism and Intergovernmental Relations 3(3,0)** Introduction to historical, theoretical, legal, and fiscal aspects of constitutionally divided government. Federal, state, and local division of responsibility for public services is emphasized along with the emerging devolution of those responsibilities from the federal government to states and localities. *Preq:* PO SC 101, Junior standing, or consent of instructor.

**PO SC 627 Public Management 3(3,0)** Examination of emerging management problems and issues facing federal, state, and local government and the application of management principles, practices, and techniques of public administration. *Preq:* PO SC 101, Junior standing, or consent of instructor.

**PO SC 628 National Security Policy 3(3,0)** National security threats and policy decision making. Issues covered include weapons of mass destruction, terrorism, organized crime, narcotics, arms control, intelligence, and homeland security. Students deliberate and assess threat priorities and crisis management. *Preq:* PO SC 102 or 104, Junior standing, or consent of instructor.

**PO SC 629 Global Security Threats 3(3,0)** Analysis, assessment, and management of the principal threats facing global security today. Topics include rogue nations, regional superpowers, alliances, organized crime, illegal weapons proliferation, and corruption. Emphasis is on the strategies available to the international community for dealing with these threats. *Preq:* PO SC 102 or 104, Junior standing, or consent of instructor.

**PO SC 632 American Constitutional Law: Structures of Government 3(3,0)** Examination and analysis of Supreme Court decisions and other legal materials in the areas of national power, federalism, the separation of powers, and the role of the judiciary. *Preq:* Junior standing or consent of instructor.

**PO SC 633 American Constitutional Law: Rights and Liberties 3(3,0)** Examination and analysis of Supreme Court decisions and other legal materials in the areas of civil rights and civil liberties, with an emphasis on freedom of speech, freedom of religion, equal protection of the laws, and privacy rights. *Preq:* Junior standing or consent of instructor.

**PO SC 642 Political Parties and Elections 3(3,0)** Study of the distinctive features of the American two-party system with emphasis on presidential elections. Parties are examined as formal organizations, coalitions of voters and interest groups, coordinators of nomination and election processes, and managers of policy-making institutions. *Preq:* PO SC 101, Junior standing, or consent of instructor.

**PO SC 654 Southern Politics 3(3,0)** Examination of the unique political environment of the American South, with emphasis on the events and social forces which have shaped politics in the region since World War II. Course material is approached from a variety of perspectives, including history, literature, social themes, and political culture. *Preq:* PO SC 101, Junior standing, or consent of instructor.

**PO SC 657 Political Terrorism 3(3,0)** Examination and analysis of the international phenomenon of terrorism in terms of origins, operations, philosophy, and objectives. *Preq:* PO SC 102 or 104, Junior standing, or consent of instructor.

**PO SC 658 Political Leadership 3(3,0)** Comparative examination of political leaders focusing particularly on types, methods, and consequences of leadership and on the relationship between leaders and followers. *Preq:* PO SC 101, Junior standing, or consent of instructor.

**PO SC 680 Gender and Politics 3(3,0)** Examination of the role of gender in politics in the United States and in other countries. Particular emphasis on the role of women in electoral politics, the impact of nationalist violence, and development policies on women's lives, and on women's rights as human rights. *Preq:* PO SC 101, 102, or 104, Junior standing, or consent of instructor.

**PO SC 685 Global Affairs and Governments 3(3,0)** Designed for teachers and education students who wish to learn how to incorporate global affairs more fully into high school curricula. Overview of major topics involving foreign policies and world politics is provided.

**PO SC 689 Selected Topics 1-3(1-3,0)** Intensive examination of a selected area of political science. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of instructor.

**PO SC 702 Research Methods for Public Administration 3(3,0)** Use of social science research methods for addressing issues in public management and policy; research design; measurement; sampling and polling; various aspects of locating, collecting, and processing data, including survey design and archive searches.

**PO SC 821 Perspectives on Public Administration 3(3,0)** Study and practice of public administration in the United States in the 20<sup>th</sup> century; historical development of the field of public administration; current approaches to the study and practice of public administration.

**PO SC 822 Public Policy Process 3(3,0)** Major models of policy making including incrementalism, rationalism, pluralism, and elitism; selected areas of public policy including transportation, poverty, energy, and the environment.

**PO SC 827 Public Personnel Administration 3(3,0)** Organization, techniques and theories of personnel management; interpersonal relations in organizations; personnel change and development; changing conditions in the public service; educational specializations, unions, collective bargaining, etc.; ethics for the public service.

**PO SC 829 Public Financial Management 3(3,0)** Organization and techniques of governmental financial management; budgetary theories; intergovernmental financial relations.

**PO SC 830 Constitutional Law for Public Administration 3(3,0)** Principles of American constitutional law; legal issues related to public administration including delegation of power, separation of powers, due process, and civil rights and liberties. May not be taken for credit by students who have taken PO SC 632 or 633 or their equivalents.

**PO SC 834 Administrative Law 3(3,0)** Legislative, adjudicatory, and general policy-making powers of administrative agencies and regulatory commissions; the scope of judicial review of administrative action. Directed primarily toward the analysis of the political nature of bureaucracy.

**PO SC 841 Public Data Analysis 3(3,0)** Various aspects of database management, storage, and retrieval; data description; univariate, bivariate, and multivariate analysis in policy studies and decision-making theory. *Preq:* EX ST 301, MTHSC 301, or equivalent.

**PO SC 860 American Government 3(3,0)** Literature of the American political system, its institutions and processes.

**PO SC 862 Administrative Leadership 3(3,0)** Foundations of leadership in public organizations; personal and organizational values underlying decision processes in the public service.

**PO SC 863 Contemporary Administrative Organizations 3(3,0)** Problems, processes, and theories of communication, decision-making, agency planning, and control in administrative agencies.

**PO SC 867 State Government Administration 3(3,0)** State government problems and policy issues emphasizing the modernization of government institutions and comparative state politics.



**PO SC 868 Local Government Administration 3(3,0)** Administration of local government from the perspective of the professional administrator; the growth of the manager form of local government; the role of local government administrators with regard to policy making, management, and the delivery of services.

**PO SC 877 Public Policy Evaluation Seminar 3(3,0)** Conceptual and analytic issues in policy and program evaluation including problem definition, goal setting, and criteria formulation; design of evaluation research; indicator design; treatment of uncertainty; and special problems raised by constraints of the political context.

**PO SC 878 Selected Topics in Public Administration 3(3,0)** In-depth study of an applied problem in public administration as seen through the practitioner's eyes; the methods used to address these problems.

**PO SC 879 Internship in Public Administration 1-3(1-3,0)** Internship with a government agency requiring a written report detailing the experience.

**PO SC 880 Capstone Seminar in Public Administration 3(3,0)** Term project integrating the material from other courses in the analysis of a contemporary public administration problem. Field work and applied project required. *Preq:* Thirty credit hours toward MPA degree and consent of instructor.

**PO SC 891 Master's Thesis Research 1-6**

## POLYMER AND TEXTILE CHEMISTRY

**P T C 615 Introduction to Polymer Science and Engineering 3(3,0)** Chemistry of monomers and polymers and the chemical and physical properties of polymers are discussed emphasizing fiber forming, synthetic polymers. Includes molecular characterization, structure, morphology, and mechanical properties as they relate to the design of polymer systems for end uses in textiles, geotextiles, plastics, and fiber-reinforced composite materials. *Preq:* CH 201; 224 or 330; P T C 304; or consent of instructor.

**P T C 616 Chemical Preparation of Textiles 3(2,3)** Chemicals used in the preparation of fabric for dyeing and finishing. Oxidizing and reducing agents and their control and effect on various fibers. Colloidal and surface active properties of various compounds and the fundamental factors influencing these properties.

**P T C 657 Dyeing and Finishing I 3(3,0)** Physical, chemical, and mechanical principles behind the application of colors and finishes to textiles. Requires an appreciation of fiber chemistry and morphology, dye and finish structures, and reactivity and mechanical principles behind the equipment used to effect transfer of these chemicals onto the textile substrate.

**P T C 658 Dyeing and Finishing II 3(3,0)** Kinetics and equilibria of dyeing processes. The use of conductivity, diffusion, and other methods for measuring absorption of isotherms and dyeing rates and the general thermodynamic relationships applicable to dyeing operations. Fiber properties such as zeta potential, dye site, and relative amorphous area available are included.

**P T C 811 Polymer Science I 3(3,0)** Fundamentals of polymer chemistry. Chemistry and synthesis of monomers and polymers in relation to thermodynamics, kinetics, and mechanisms of polymerization reactions emphasizing fiber-forming polymers, plastics, and composite matrix materials. Offered fall semester only.

**P T C 812 Polymer Science II 3(3,0)** Chemical structure and properties of polymers. Polymer solution properties, the viscoelastic state, and the crystalline morphology of polymeric materials. Current theories for describing polymer thermal transitions, molecular weight, molecular weight distributions, and transport phenomena in polymeric systems, as well as interfacial phenomena. Offered spring semester only.

**P T C 830 Multicomponent Polymeric Materials 3(3,0)** Principles of advanced multicomponent polymeric materials and systems based on the following topics: different polymer-polymer and polymer-nonpolymer combinations; multicomponent materials synthesis, fabrication, properties, and applications; modification and instrumental characterization of polymer surfaces and interfaces; functional coatings, nanocomposites, adhesives, nanodevices, polymer blends and composites, interpenetrating polymeric networks, and block-copolymers. *Preq:* Introductory polymer course or consent of instructor.

**P T C 840 Analytical Methods in Textile and Polymer Science 4(3,3)** Use of chemical and physical instrumental methods to characterize polymeric materials in textile and polymer science; basic principles and unique problems encountered when techniques such as IR, NMR, GC, LC, MS, GC/MS and thermal analysis, microscopy, and tensile testing are applied to polymeric materials. Offered spring semester only. *Preq:* Consent of instructor.

**P T C 891 Master's Thesis Research 1-12**

## PSYCHOLOGY

**PSYCH 626 Advanced Physiological Psychology 3(3,0)** Advanced studies in the biological basis of behavior with emphasis on functional neuroanatomy and endocrinology. Topics may vary. May not be repeated for credit. *Preq:* PSYCH 324 or consent of instructor.

**PSYCH 659 Group Dynamics 3(3,0)** Review of current theory and research on small-group processes with emphasis given to group formation and development, group structure, the dynamic forces within a group, leadership, and group problem solving and decision making. *Preq:* PSYCH 201 with a C or better and one 300-level psychology course or consent of instructor.

**PSYCH 662 Psychology and Culture 3(3,0)** Seminar examining the cultural context in which psychological theories and research are generated and psychological perspectives on human diversity. Topics include the philosophical positions influencing psychological theory and research; methodological issues in the study of diversity; historical and contemporary perspectives; and cross-cultural psychological research in selected content areas. *Preq:* PSYCH 310 or consent of instructor.

**PSYCH 680 Health Psychology 3(3,0)** Study of the role of health-related behaviors in the prevention, development, and/or exacerbation of health problems. Emphasis is on the biopsychosocial model and its application in the assessment, treatment, and prevention of health problems. *Preq:* PSYCH 201 with a C or better and one 300-level psychology course or consent of instructor.

**PSYCH 683 Abnormal Psychology 3(3,0)** Introduction to the diagnosis and treatment of mental illness. Uses current diagnostic standards for mental disorders as a framework for understanding the symptoms, causes, and treatments of the most commonly observed maladaptive behaviors. *Preq:* PSYCH 201 with a C or better and one 300-level psychology course or consent of instructor.

**PSYCH 689 Selected Topics 3(3,0)** Seminar in current topics in psychology. Topics vary from semester to semester and are announced prior to each semester's registration. May be repeated once for credit, but only if different topics are covered. *Preq:* PSYCH 201 with a C or better and one 300-level psychology course or consent of instructor.

**PSYCH 810 Research Design and Quantitative Methods I 3(3,0)** Overview of applied data analysis in industrial and other work-related settings. Analysis techniques focus on the General Linear Model approach to ANOVA and regression. *Preq:* Six credits of statistics, research methods or equivalent.

**PSYCH 811 Research Design and Quantitative Methods II 3(3,0)** Research methodologies; experimental, quasi-experimental, and nonexperimental designs emphasizing applied psychological research; scientific method; basic versus applied research; technical writing; grant writing and ethics. *Preq:* PSYCH 810.

**PSYCH 813 Research Design and Quantitative Methods III 3(3,0)** Advanced course in applications of multivariate data analysis in industrial and other work-related settings. Topics include the major advanced and multivariate data analytic tools needed for research in applied psychology. *Preq:* PSYCH 810 or consent of instructor.

**PSYCH 815 Advanced Studies in Systems and Theories 3(3,0)** Foundations of contemporary psychology, origins of major theories, conceptions of scientific knowledge implicit in them, and reasons for accepting or rejecting them. *Preq:* PSYCH 415 or consent of instructor.

**PSYCH 822 Human Perception and Performance 3(3,0)** Basic research on human perception as applied to task performance; vision and audition in adults; basic knowledge of human sensory and perceptual characteristics as applied to such tasks as machine operation, task performance, etc.

**PSYCH 823 Perception, Cognition, and Technology 3(3,0)** Fundamentals of sensory and perceptual processes focusing on human vision and audition. Emphasis is on perceptual aspects of applications and communication in electronic and traditional media. Topics include perception of speech, time, depth, color, and motion in natural and virtual environments, as well as psychophysics, attention, eye movements, and reading. *Preq:* Enrollment in MFAC degree program or consent of instructor.



**PSYCH 833 Advanced Cognitive Psychology 3(3,0)** Research and theory concerning perception, memory, reasoning, problem solving, knowledge representation, psychology of language, semantics, attention, concept formation, and other high-level mental processes. Applications of these areas are considered.

**PSYCH 835 Advanced Human Factors Psychology 3(3,0)** Foundation from which to study interactions between human beings and systems in order to maximize safety, performance, and user satisfaction. Integration and application of basic research and theory in sensation, perception, cognition, and motor control. *Preq:* Consent of instructor.

**PSYCH 837 Ergonomics for Applied Psychology 3(3,0)** Perception and action capabilities of humans as they relate to the design of machines and environments; biomechanics, anthropometry, human movement and work, and the perceptual supports action.

**PSYCH 840 Usability Analysis and Crew Assessment 3(3,0)** Hands-on exposure to human factors methods for evaluating the usability of computer interfaces and assessing team performance in fast-paced tasks. May include cognitive task analysis, heuristic evaluation, usability testing, sequential data analysis, cognitive modeling, workload and situation-awareness measurement, measurement of team knowledge, operating simulators. *Preq:* PSYCH 810 or 835 or consent of instructor.

**PSYCH 845 Advanced Studies in Adulthood and Aging 3(3,0)** Human development from young adulthood through late adulthood. Biological, cognitive, personality development, and social development are examined from the perspective of several major theoretical frameworks. *Preq:* PSYCH 345 or consent of instructor.

**PSYCH 852 Advanced Studies in Social Psychology 3(3,0)** Human social behavior from the perspective of the individual as a participant in social relationships; contemporary theories of human social behavior and human behavior in social settings. *Preq:* PSYCH 352 or consent of instructor.

**PSYCH 860 Psychology of Training and Evaluation 3(3,0)** Evaluation issues such as criteria development, organizational assessment, process, and outcome criteria along with instructional methodologies such as fairness in training, special populations, second careers, hard-core unemployment, and ethics of organizational and industrial change. *Preq:* A course in industrial psychology, personnel psychology, or equivalent.

**PSYCH 861 Personnel Psychology 3(3,0)** Theory, techniques, and legal issues involved in the effective matching of individuals' needs, preferences, skills, and abilities with the needs and preferences of organizations. Topics include research methods, prediction issues, tests and other predictors, decision making, and job evaluation. *Preq:* PSYCH 810.

**PSYCH 862 Organizational Development 3(3,0)** Forms of organizational structure and basic theories of organizations. Theories and technologies of organizational development and change. Relationships between organizational design and technology. *Preq:* A course in industrial/organizational psychology or equivalent.

**PSYCH 863 Work Motivation and Satisfaction 3(3,0)** Explanations for absenteeism, productivity, job satisfaction, and withdrawal, as well as their interrelations. Methods of measuring attitudes and opinions and general theories of human motivation. *Preq:* A course in industrial/organizational psychology or equivalent.

**PSYCH 864 Performance Appraisal 3(3,0)** Job measurement and the psychological processes involved in performance appraisal. Current methods, theory, and applications in the measurement of job performance. Training in the development and evaluation of performance appraisal systems. *Preq:* PSYCH 364 or consent of instructor.

**PSYCH 866 Attitude Measurement Theory 3(3,0)** Classic and contemporary approaches to attitude theory, measurement, and scaling techniques. Theories of job satisfaction. Measurement of attitudes toward work. *Preq:* PSYCH 471 or consent of instructor.

**PSYCH 867 Legal Issues in Personnel 3(3,0)** Discrimination law and its relevance to the practice of industrial/organizational psychology. Compliance with Title 7, the Age Discrimination in Employment Act, and the Americans with Disabilities Act. *Preq:* PSYCH 861 and 871 or consent of instructor.

**PSYCH 868 Leadership in Organizations 3(3,0)** Theories of leadership and current leadership research. Theoretical approaches include trait, behavioral, contingency, transactional, and transformational approaches. Current leadership issues may include leadership perceptions, gender and leadership, and executive succession. *Preq:* A course in industrial/organizational psychology or equivalent.

**PSYCH 869 Advanced Personnel Selection 3(3,0)** Advanced seminar covering details of personnel selection techniques used in organizations. Techniques covered may include biodata, cognitive and physical ability tests, personality tests, interviews, and assessment centers. *Preq:* PSYCH 861.

**PSYCH 871 Psychological Tests and Measurement 3(3,0)** Advanced survey of psychological test development, evaluation, and utilization in organizational and research settings; professional guidelines for the practice of testing in industrial/organizational psychology and legal guidelines for using tests in industry. *Preq:* Consent of instructor.

**PSYCH 873 Structural Equation Modeling in Applied Psychology 3(3,0)** Fundamentals of the statistical techniques involved in structural equation modeling (SEM) in applied psychology. SEM is a regression-based technique that incorporates elements of path analysis, confirmatory factor analysis, and structural models. *Preq:* PSYCH 810 or consent of instructor.

**PSYCH 882 Survey of Occupational Health Psychology 3(3,0)** Issues in the newly developing field of occupational health psychology; integration of knowledge bases from human factors, industrial-organizational, health psychology, and related disciplines; biopsychosocial perspective where students develop problem-solving skills and interdisciplinary knowledge. *Preq:* Prior psychology coursework or consent of instructor.

**PSYCH 883 Advanced Studies in Abnormal Psychology 3(3,0)** Seminar on the etiology and classification of abnormal behavior; empirical and theoretical issues in the understanding of mental disorders; cultural influences on judgment of abnormality; in-depth examination of specific psychological disorders. *Preq:* PSYCH 483 or consent of instructor.

**PSYCH 891 Master's Thesis Research 1-3**

**PSYCH 895 Applied Psychology Internship 3-6(0,3-6)** Supervised field experience in industry, business, or government. Site location, on-site supervision, and credit hours must be approved in advance by graduate coordinator.

**PSYCH 897 Special Problems in Applied Psychology 1-3** Study of a particular topic under the direction of a faculty member. Specific program is organized by student and faculty member and submitted to graduate coordinator for approval. Project is not used to support MS thesis or dissertation. May be repeated for a maximum of 21 credits.

**PSYCH 899 Selected Topics 3(3,0)** Selected current and classic topics not covered in other courses. May be repeated for credit.

**PSYCH 991 Doctoral Dissertation Research 1-9**

## READING

**READ 860 Reading Instruction in the Elementary School 3(3,0)** Knowledge and skills necessary for teaching reading to varied types of elementary school learners. *Preq:* Consent of instructor.

**READ 861 Fundamentals of Basic Reading 3(3,0)** Historical progression of the teaching of reading; current theories and reading practices; teaching basic reading skills.

**READ 862 Clinical Research in Reading 3(3,0)** Reading research and literature; original investigation in such problems as development of reading skills and attitudes, clinical procedures, and techniques is required. *Preq:* READ 861.

**READ 863 Organizing and Supervising Reading Programs 3(3,0)** Supervisory problems with planning reading programs; analysis of methods and materials of teaching; evaluation of reading programs. *Preq:* One of the following: READ 860, 861, 864, 865, 869.

**READ 864 Teaching Secondary School Reading 3(3,0)** Methods and materials for secondary reading programs in developmental, corrective, remedial, adapted, content, and recreational areas.

**READ 865 Evaluation and Remediation of Reading Problems 3(2,3)** Remedial methods and materials for teaching reading; use of diagnostic instruments and interpretation of test results. Students participate in laboratory/field experience and prepare case studies with summary of diagnosis emphasizing remediation procedures. *Preq:* READ 860, 861, or 864.

**READ 866 Practicum in Reading 3(2,2)** Supervised practicum emphasizing diagnostic and remedial work with readers in public schools. *Preq:* READ 865, consent of instructor.

**READ 867 Middle School Reading 3(3,0)** Techniques, materials, and theories for teaching reading to middle school students emphasizing correlating reading skills into the content area. *Preq:* Education major or consent of instructor.



**READ 868 Using Literature and Technology for Reading Instruction 3(3,3)** Provides early childhood, elementary, and middle school teachers with theory and knowledge needed to utilize technological and library resources and make appropriate literature selections for the teaching of reading.

**READ 869 Integrated Approach to Reading and Writing Instruction 3(3,0)** Understanding of the reading/writing processes for early childhood and elementary teachers; investigation of the whole language approach in the classroom. *Preq:* READ 861 or equivalent.

**READ 870 Early Literacy: Strategic Reading and Writing Instruction 3(3,0)** Use of the theoretical base of the Reading Recovery program to modify instructional practices to include generalizable instructional procedures. *Preq:* READ 860 or equivalent.

**READ 871 Literacy Across the Curriculum 3(3,0)** Use of the theoretical base of the Reading Recovery program to modify instructional practices to include reading and writing activities in all aspects of K-5 curriculum. *Preq:* READ 860 or equivalent and 870.

**READ 872 Guided Reading and Guided Writing 3(3,0)** Use of the techniques of Guided Reading, Shared Writing, and Interactive Writing appropriately in classroom situations. Demonstration of how the difficulty level of teaching practice must change over time as students move from dependence on assistance to independence during the reading and writing processes. *Preq:* READ 860 or equivalent and 871.

**READ 873 Models for Balanced Literacy 3(3,0)** Prepares classroom teachers to organize K-5 classrooms for balanced literacy instruction. Participants apply classroom organization procedures in actual K-5 classrooms. *Preq:* READ 860 or equivalent, 865, and 872.

**READ 880 Reading Recovery Teacher I 3(3,0)** First in a two-semester, two-course sequence designed to prepare teachers to implement and teach a Reading Recovery Program. Issues related to reading theory and process, instructional processes, program implementation, and evaluation. *Preq:* Consent of instructor. *Coreq:* READ 882.

**READ 881 Reading Recovery Teacher II 3(3,0)** Second in a two-course sequence designed to prepare teachers to implement and teach in a Reading Recovery Program. Issues related to reading theory and process, instructional process, program implementation, and evaluation. *Preq:* Admission into the Clemson Reading Recovery Program, READ 880, 882. *Coreq:* READ 883.

**READ 882 Reading Recovery Teacher Practicum I 3(0,9)** Teaching experience allowing teachers to develop and practice responsibilities of implementing and teaching first grade children in a Reading Recovery program. Participants implement content studied in READ 880. *Preq:* Consent of instructor. *Coreq:* READ 880.

**READ 883 Reading Recovery Teacher Practicum II 3(0,9)** Teaching experience and practice in implementing and teaching in a Reading Recovery Program. Participants implement content studied in READ 881. *Preq:* Admission into the Clemson University Reading Recovery Program, READ 880, 882. *Coreq:* READ 881.

**READ 884 Reading Recovery Clinical I 3(3,0)** First in a two-course sequence aimed at providing leadership experiences in implementing a Reading Recovery Program in an elementary school setting. *Preq:* Admission into the Clemson University Reading Recovery Teacher Leader program. *Coreq:* READ 886, 937.

**READ 885 Reading Recovery Clinical II 3(3,0)** Second in a two-course sequence aimed at providing leadership experiences in implementing a Reading Recovery Program in an elementary school setting. *Preq:* Admission into the Clemson University Reading Recovery Teacher Leader program. *Coreq:* READ 887, 938.

**READ 886 Reading Recovery Teacher Leader Practicum I 3(0,9)** First in a two-course sequence designed to prepare Reading Recovery Teacher Leaders to implement a school-based program, supervise teachers, and carry out responsibilities related to maintaining a Reading Recovery site. *Preq:* Admission into the Clemson University Reading Recovery Teacher Leader program. *Coreq:* READ 884, 937.

**READ 887 Reading Recovery Teacher Leader Practicum II 3(0,9)** Second in a two-course sequence designed to prepare Reading Recovery Teacher Leaders to implement a school-based program, supervise teachers, and carry out responsibilities related to maintaining a Reading Recovery site. *Preq:* Admission into the Clemson University Reading Recovery Teacher Leader program. *Coreq:* READ 885, 938.

**READ 937 Reading Recovery Theory I 3(3,0)** First of a two-course sequence designed to examine theoretical principles of the reading process as applied in the Reading Recovery Program. Issues related to program implementation and systematic program changes. *Preq:* Consent of instructor. *Coreq:* READ 884, 886.

**READ 938 Reading Recovery Theory II 3(3,0)** Second of a two-course sequence designed to examine theoretical principles of the reading process as applied in the Reading Recovery program. Issues related to program implementation and systematic program changes. *Preq:* Consent of instructor. *Coreq:* READ 885, 887.

**READ 939 The Psychology of Teaching Reading 3(3,0)** Psychological basis of the reading process; principles applied in teaching reading. *Preq:* READ 860 or 861 or consent of instructor.

**READ 940 Advanced Diagnosis and Remediation in Reading 3(2,3)** Advanced diagnosis and remediation in reading; review of diagnostic instruments and instructional materials. *Preq:* READ 860 or 861; 865; or consent of instructor.

**READ 941 Advanced Practicum in Reading 3(2,3)** Diagnosis and remediation testing; remediation. Extensive case studies with recommendation for the classroom teacher are required. *Preq:* READ 940 and consent of instructor.

**READ 942 Teaching Reading Through a Literature Emphasis 3(3,0)** Strategies for integrating literature into the traditional reading program. *Preq:* An introductory reading class or equivalent.

**READ 943 The Reading-Writing Connection: An Integrated Approach 3(3,0)** Theoretical bases and practical techniques for teaching reading and writing in an integrated manner; reading and writing as processes; basic skills instruction in a coordinated program; multiple subject areas; use of student interest and ability. *Preq:* Basic reading methods course.

**READ 944 Reading Research: Review and Critique of the Literature 3(3,0)** Historical and contemporary research in reading and related literacy fields. *Preq:* Admission to the PhD program in Curriculum and Instruction.

**READ 945 Special Problems in Reading Education 3(1,4)** Individual study of a specific topic in reading. Students may choose from a large diversity of topics. *Preq:* READ 860 or 861; READ 862, 865, ED F 808; or consent of instructor.

## REAL ESTATE DEVELOPMENT

**RED 800 Real Estate Development Process 3(3,0)** Real estate and land development process from the developer's perspective. Cases and lectures are presented by leading experts in the development industry. Emphasizes participants of the development team and how to become a developer/"master builder" to create a superior built environment. *Preq:* Consent of instructor.

**RED 801 Real Estate Market Analysis 3(3,0)** Processes and data sources used to analyze the supply and demand for various building types. Explores demographic, technological, and economic trends affecting markets. General market analysis supply and demand approaches, including the use of GIS, are developed and applied primarily to residential, retail, and office markets at specific sites. *Preq:* Consent of instructor.

**RED 802 Real Estate Development Field Tour Seminar 3(0,9)** Examines the processes of creating quality development within the risk-reward framework focusing on design feasibility from the perspectives of the development team. Approximate two-week tour of the South Carolina Coast or other environs visits approximately forty developments and the key actors involved. To be taken Pass/Fail only. *Preq:* MRED student or consent of instructor.

**RED 803 Public-Private Partnership Development 3(3,0)** Focuses on public-private partnerships in the structuring, negotiating, and implementing the design, development, construction, and management of buildings and areas. Emphasis is on redevelopment/rehab and infill development; incentive tools and techniques, and market and feasibility issues for development within the risk-reward framework. *Preq:* RED 800 and consent of instructor.

**RED 804 Practicum in Residential and Master Planned/Resort Communities 3(3,0)** Exploration of the residential development process, especially for large-scale subdivisions and master planned/resort communities. Guest speakers, case studies, and field visits are used. Capstone preliminary feasibility analysis for a real world proposed development is completed by diverse student teams. *Preq:* Consent of instructor.



**RED 805 Practicum in Commercial Development** 3(3,0) Exploration of the commercial development process, especially for office and retail properties. Guest speakers, case studies, and field visits are used. Capstone preliminary feasibility analysis is completed by diverse student teams for a real world proposed development. *Preq:* Consent of instructor.

**RED 810 Real Estate Seminar Roundtable** 1(1,0) Weekly course which brings students and premier real estate professionals together through on-site or videoconference sessions. Presentations and discussions occur regarding cutting-edge projects and industry issues from around the country and internationally. May be repeated for a maximum of two credits. To be taken Pass/Fail only. *Preq:* Enrollment in MRED program or consent of instructor.

**RED 811 Summer Internship in Real Estate Development** 3(0,9) Preplanned, preapproved, faculty-supervised internship designed to give students on-the-job learning in support of classroom education. Internships must be no less than ten full-time, consecutive weeks with same internship provider. Ancillary study abroad experience or two, three-credit classes in place of internship requirement are possible with approval of MRED Director. To be taken Pass/Fail only.

**RED 889 Selected Topics** 3(3,0) Topics emphasizing current literature and results of current research. May be repeated for a maximum of nine credits, but only if different topics are covered. *Preq:* Consent of instructor.

**RED 890 Directed Study** 1-3(0,3-9) Students pursue individual professional interests under guidance of individual faculty as approved by MRED Director. Offered for elective credit for students in MRED program. May be repeated for a maximum of six credits.

## RELIGION

**REL 601 Studies in Biblical Literature and Religion** 3(3,0) Critical examination of a selected topic in biblical studies. Topics vary from year to year. May be repeated once for credit. *Preq:* Consent of instructor.

**REL 602 Studies in Religion** 3(3,0) Thorough examination of a selected topic in one or more of the religious traditions of the world or of religious life in a particular region. Topics vary from year to year. May be repeated for a maximum of six credits. *Preq:* Consent of instructor.

**REL 604 History of Early Christianity** 3(3,0) Study of the history, social and doctrinal, of early Christianity up to 600 A.D. *Preq:* Consent of instructor.

**REL 635 Religious Institutions in Community Life** 3(3,0) Explores the particular significance of religious organizations as core institutions in American communities and examines their involvement with community political and social structures.

## RURAL SOCIOLOGY

**R S (SOC) 601 Human Ecology** 3(3,0) Analysis of the interrelationships among the physical world, modifications in natural environments, human settlement patterns, and institutions that both encourage and regulate environmental modification. Emphasis is on conditions whereby natural resources become public policy concerns. Offered spring semester only. *Preq:* Sophomore standing.

**R S (SOC) 659 The Community** 3(3,0) Close analysis of the development of contemporary communities and their place in society. Continuing effects of industrialization, migration, and technological change on community location and structure are examined. Structural relations of social class, status, and the associations among institutions are explored.

**R S (SOC) 671 Demography** 3(3,0) See Soc 671.

**R S 881 Special Problems in Rural Social Research** 1-3(0,2-6) Recent research problems and literature emphasizing research design, analysis, theoretical generalizations, and application programs. May be repeated for a maximum of six credits. *Preq:* Six credit hours of 600-level sociology or rural sociology courses or consent of instructor.

## SECONDARY EDUCATION

**EDSEC 637 Technology in Secondary Mathematics** 3(3,0) Students learn how to integrate calculators, data collectors, and computers in the secondary mathematics curriculum. They solve problems from middle school, Algebra I, Geometry, and Algebra II courses. *Preq:* Second semester Junior standing, admission to the professional level.

**EDSEC 765 Secondary School Curriculum** 3(3,1) Principles, techniques, and trends in secondary school curriculum development and evaluation.

**EDSEC 770 Science Laboratory and Field Instruction** 3(3,0) Methods of designing and conducting laboratory and field learning activities in secondary science courses. *Preq:* Undergraduate science teaching methods course or consent of instructor.

**EDSEC 803 Advanced Methods of Teaching in the Secondary School** 3(3,1) Principles and practices involved in promoting effective active learning in secondary schools.

**EDSEC 811 Middle Grades Language Arts Methods/Practicum** 3(2,4) Development of instructional practices appropriate for middle grades language arts teachers; familiarization with curriculum materials. Includes field work in local schools. *Preq:* Admission to MAT program.

**EDSEC 812 Middle Grades Social Studies Methods/Practicum** 3(2,4) Development of instructional practices appropriate for middle grades social studies teachers; familiarization with curriculum materials. Includes field work in local schools. *Preq:* Admission to MAT program.

**EDSEC 813 Middle Grades Math Methods/Practicum** 3(2,4) Development of instructional practices appropriate for middle grades mathematics teachers; familiarization with curriculum materials. Includes field work in local schools. *Preq:* Admission to MAT program.

**EDSEC 814 Middle Grades Science Methods/Practicum** 3(2,4) Development of instructional practices appropriate for middle grades science teachers; familiarization with curriculum materials. Includes field work in local schools. *Preq:* Admission to MAT program.

**EDSEC 821 Middle Grades Language Arts Methods/Student Teaching** 3(2,4) Continued development of instructional practices appropriate for middle grades language arts teachers; familiarization with additional curriculum materials. Includes field work in local schools. *Preq:* Admission to MAT program.

**EDSEC 822 Middle Grades Social Studies Methods/Student Teaching** 3(2,4) Continued development of instructional practices appropriate for middle grades social studies teachers; familiarization with additional curriculum materials. Includes field work in local schools. *Preq:* Admission to MAT program.

**EDSEC 823 Middle Grades Math Methods/Student Teaching** 3(2,4) Continued development of instructional practices appropriate for middle grades math teachers; familiarization with additional curriculum materials. Includes field work in local schools. *Preq:* Admission to MAT program.

**EDSEC 824 Middle Grades Science Methods/Student Teaching** 3(2,4) Continued development of instructional practices appropriate for middle grades science teachers; familiarization with additional curriculum materials. Includes field work in local schools. *Preq:* Admission to MAT program.

**EDSEC 841 Advanced Studies in the Teaching of Secondary School English** 3(3,1) Methods of teaching secondary school English based on research and review of current literature. *Preq:* EDSEC 424 or equivalent, master's degree, or consent of instructor.

**EDSEC 842 Advanced Studies in the Teaching of Secondary School Mathematics** 3(3,1) Relationship between mathematics teaching theory and practice as shown in the research literature. Emphasis is on inquiry and other student-centered strategies. Issues and techniques in secondary mathematics. *Preq:* EDSEC 426 or equivalent, master's degree, or consent of instructor.

**EDSEC 843 Advanced Studies in the Teaching of Secondary School Science** 3(3,1) Methods of science teaching theory and practice as shown by current research literature. Emphasis is on laboratory, inquiry, and other student-centered teaching strategies. Techniques in science curriculum development. Issues in science teaching. Science teaching leadership skills. *Preq:* EDSEC 427 or equivalent, master's degree, or consent of instructor.

**EDSEC 844 Advanced Studies in the Teaching of Secondary School Social Studies** 3(3,1) Social studies teaching strategies derived from major theories of learning and contemporary research; curricular issues in social studies education. *Preq:* EDSEC 428 or equivalent, master's degree, or consent of instructor.

**EDSEC 846 Current Literature in English Education** 3(3,1) Research literature in English education; examination of literature in research methods and curriculum in English teaching. *Preq:* A methods course in English education.



**EDSEC 847 Current Literature in Mathematics Teaching 3(3,1)** Recent literature of mathematics education; examination of literature in both the research and curriculum in secondary mathematics teaching. *Preq:* A graduate teaching methods course or consent of instructor.

**EDSEC 848 Current Literature in Science Teaching 3(3,1)** Recent literature of science education; examination of literature in both the research and curriculum in secondary science teaching. *Preq:* A graduate teaching methods course or consent of instructor.

**EDSEC 849 Current Literature in Social Studies Teaching 3(3,1)** Recent literature in social studies education; examination of literature in both curriculum and instruction. *Preq:* A graduate teaching methods course or consent of instructor.

## SOCIOLOGY

**SOC (R S) 601 Human Ecology 3(3,0)** See R S 601.

**SOC 604 Sociological Theory 3(3,0)** Survey of the development of sociological theory. Required of all sociology majors. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC 614 Policy and Social Change 3(3,0)** Uses the sociological perspective to examine policy development, implementation, and evaluation in the public and private sectors. Specifically, focuses on values and ethics and the effects of social change efforts on the outcomes of policy formation, social planning and implementation. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC 633 Globalization and Social Change 3(3,0)** Examination of the social and historical causes of development and underdevelopment in societies. Various sociological theories of development are reviewed. Selected countries are examined in an international context. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC 635 Leadership and Team Building 3(2,3)** Introduction to leadership and the process of building effective teams. Examines various sociological perspectives on leadership and their role in developing and maintaining various types of groups. Students are actively involved in the educational process through experiential learning opportunities. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC 640 Leisure, the Mass Media, and Culture 3(3,0)** Production and consumption of leisure activities in contemporary society; popular culture and the mass media as dominant leisure forms; social effects of leisure activities; relationship between work and leisure. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC 641 Sociology of Sport 3(3,0)** Sport as a social phenomenon emphasizing leadership, discrimination, socialization, communication, conflict, and cooperation in sports; emerging social issues in contemporary sports. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC (R S) 659 The Community 3(3,0)** See R S 659.

**SOC 660 Race, Ethnicity, and Class 3(3,0)** Investigation of sociological perspectives on race, ethnic relations, and social stratification. Analysis of the impact of social class on minority movements. Not open to students who have taken SOC 431. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC 663 Sociology of Parenting 3(3,0)** Sociology of parenting, child rearing, parenting styles, and outcomes; social change and parenting; variations by sex, race, and class; cross-cultural comparisons; research-based with applied orientation. *Preq:* SOC 201, Junior standing.

**SOC (R S) 671 Demography 3(3,0)** Demographic concepts, theory, and research methods for vital statistics, migration, and population distribution and projections. Collection and processing of demographic data and organization of demographic data systems. Offered fall semester only. *Preq:* ANTH 201 or R S 301 or SOC 201.

**SOC 680 Medical Sociology 3(3,0)** Sociocultural factors in the etiology and treatment of physical illness; medical occupations and professions; organization of health-care delivery systems. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC 681 Aging and Death 3(3,0)** Sociological orientation to aging populations focusing on the impact of health care, welfare, and retirement systems. Includes dying as a social phenomenon, suicide, euthanasia, funerals. Not open to students who have taken SOC 383. *Preq:* SOC 201 and Junior standing or consent of instructor.

**SOC 684 Child Abuse and Treatment 3(3,0)** Comprehensive examination of child abuse, neglect, and exploitation as major social problems; causes, effects, and prevalence of physical, sexual, and emotional maltreatment; definitional controversies; social policy and legal considerations; therapeutic approaches for children and their caretakers; child maltreatment and the judicial system. *Preq:* SOC 201 and Senior standing or consent of instructor.

**SOC 693 Sociology of Corrections 3(3,0)** Analysis of correctional alternatives. Topics include sentencing strategies and their impact, prison populations (male, female, and juvenile), inmate social structures, treatment and custody issues, community based alternatives (probation, parole, electronic monitoring, and work release), and correctional management issues. *Preq:* SOC 390 or consent of instructor.

**SOC 694 Sociology of Organized Crimes 3(3,0)** Examines the multifarious aspects of criminal organizations, namely their structure, methods, and networks. Specific topics may include white-collar crime and traditional, nontraditional, and transnational organized crime. *Preq:* SOC 201 or consent of instructor.

**SOC 803 Survey Designs for Applied Social Research 4(3,2)** Survey research design principles, procedures, and techniques used in applied sociology; instrumentation; data collection, management, and interpretation. Offered fall semester only. *Preq:* SOC (R S) 303 or equivalent.

**SOC 805 Evaluation Research 3(3,0)** Research methods and techniques of computer-assisted data management and analyses used in evaluating policies, operation, organization, and effectiveness of social programs in the private and public sectors; microcomputer software packages available for these purposes. Offered spring semester only. *Preq:* SOC 803.

**SOC 807 Advanced Research Methods 3(3,0)** Advanced methods in social research; measuring techniques and data analysis strategies; practical experience in various phases of social research. Offered spring semester only. *Preq:* SOC 803.

**SOC 810 Theoretical Models in Applied Social Research 3(3,0)** Comparative analysis of theoretical models in sociology and their uses in applied research; uses of these models in research concerned with the processes of industrial and economic growth and development. *Preq:* SOC 404 or equivalent.

**SOC 830 Human Systems Development: Organizations and Society 3(3,0)** Complex organizations such as human systems with primary focus on development and change, interorganizational relations and the influence of these structures on the community life. Offered fall semester only. *Preq:* SOC 430 or equivalent.

**SOC 836 Environmental Sociology 3(2,3)** Introduction to environmental sociology; relationship among human behavior, society, and the environment; focuses on the natural rather than the built environment; U.S. and global issues.

**SOC 891 Master's Thesis Research 1-12**

**SOC 892 Selected Topics in Sociology 3(3,0)** Current topics in applied sociology not covered in other graduate courses. May be repeated once for credit.

**SOC 895 Field Experience 3-6** Supervised full-time work experience in a public agency or private enterprise to gain planning, research, and policy experience. May not be repeated for credit. To be taken Pass/Fail only. Offered summer session only. *Preq:* 12 hours of 800-level coursework in sociology.

**SOC 896 Independent Study 1-3(1-3,0)** Individual readings or research in a topic area selected according to a student's interests or program needs. May be repeated for a maximum of six credits. *Preq:* Approval of director of graduate studies.

## SPANISH

**SPAN 151 Spanish for Graduate Students 3(3,0)** Intensive program only for graduate students preparing for the reading examination in Spanish. A minimum grade of B on final exam will satisfy Graduate School foreign language requirement. To be taken Pass/Fail only. May be repeated once. *Preq:* Graduate standing.

**SPAN 699 Special Topics 3(3,0)** Study of timely or special topics in Spanish. May be repeated for a maximum of six credits, but only if different topics are covered. *Preq:* Consent of department chair.



## SPECIAL EDUCATION

**ED SP (PRTM) 614 Recreation and Leisure for Special Populations 3(3,0)** See PRTM 614.

**ED SP 669 Characteristics of Individuals with Emotional and Behavioral Disorders 3(3,0)** Addresses the characteristics of individuals with emotional and behavioral disorders. Consideration is given to historical and legal aspects, definitions, comprehensive assessment, and the impact of school, home, culture, and society on individuals with behavior disorders. Research findings in the field of behavior disorders are emphasized. *Preq:* ED SP 370.

**ED SP 670 Characteristics of Individuals with Learning Disabilities 3(3,0)** Provides specific knowledge of definitions, evaluation procedures, cognitive, social, academic, and functional skills of individuals with learning disabilities across the lifespan. *Preq:* ED SP 370.

**ED SP 672 Characteristics of Individuals with Mental Retardation 3(3,0)** Characteristics of mental retardation across the lifespan; learning, behavioral, and developmental aspects are examined. *Preq:* ED SP 370.

**ED SP 673 Educational Procedures for Individuals with Mental Retardation 3(3,0)** Identification, selection, and preparation of functional curriculum materials and pedagogy for teaching students with mental retardation. A multidisciplinary, student-centered approach to program planning provides the framework. *Preq:* ED SP 472.

**ED SP 674 Procedures for Individuals with Emotional and Behavioral Disorders 3(3,0)** Assists students in developing specific strategies for teaching individuals with emotional and behavioral disorders, utilizing preventive measures, expanding skills in behavior analysis, and implementing the least restrictive intervention warranted. Includes programmatic considerations, social skill instruction, curriculum selection, IEP development, and effective transition. *Preq:* ED SP 469.

**ED SP 675 Educational Procedures for Individuals with Learning Disabilities 3(3,0)** Provides knowledge of educational evaluation and instructional procedures to improve outcomes for individuals with learning disabilities. *Preq:* ED F 302, ED SP 370, PSYCH 201; or consent of instructor.

**ED SP 676 Practicum in Learning Disabilities 3(2,3)** Addresses content knowledge, skills, and professional values for successful teaching of students with learning disabilities. Focuses on teacher-directed instruction and the use of critical instructional factors, the use of recommended practices for individuals with learning disabilities, and the measurement and analysis of student performance data. *Preq:* ED SP 470, 475; completion of student teaching.

**ED SP 678 Practicum in Emotional and Behavioral Disorders 3(2,3)** Addresses content knowledge, performance skills, and professional values for successful teaching of students with emotional and behavioral disorders. Focuses on teacher-directed instruction and the use of critical instructional factors, the use of recommended practice for students with disabilities, and the measurement and analysis of student performance data. *Preq:* ED SP 474; completion of student teaching.

**ED SP 679 Practicum in Mental Retardation 3(2,3)** Addresses content knowledge, performance skills, and professional values for successful teaching of students with mental retardation. Focuses on teacher-directed instruction and the use of critical instructional factors, the use of recommended practices for students with disabilities, and the measurement and analysis of student performance data. *Preq:* ED SP 473; completion of student teaching.

**ED SP 738 Selected Topics in Special Education 1-3(1-3,0)** Specific master's-level special education topics not found in other courses. May be repeated for a maximum of six credits, but only if different topics are covered.

**ED SP 739 Independent Study in Special Education 1-3(1-3,0)** Master's-level study of selected topics in special education under the direction of a faculty member chosen by the student; development of a course of study different from any existing courses and designed for the individual student. May be repeated for a maximum of six credits, but only if different topics are covered.

**ED SP 820 Language Arts Instruction for Individuals with Disabilities 3(3,1)** Research-based methods for instructing individuals with disabilities; principles of effective language arts instruction in reading, writing, speaking, and listening skills. *Preq:* A course in reading methods or consent of instructor.

**ED SP 821 Educational Assessment of Individuals with Disabilities 3(3,1)** Introduction to the assessment process in special education by addressing procedural safeguards; data collection via informal and standardized procedures; issues in assessment; psychometric properties of standardized tests; and administration, scoring, and interpretation of selected instruments. *Preq:* ED SP 370 or consent of instructor.

**ED SP 822 Teaching Mathematics to Individuals with Disabilities 3(3,1)** Procedures for teaching mathematics to individuals with disabilities using direct instruction as an approach to assessment, instructional planning, and evaluation. Research in mathematics instruction for individuals with disabilities and mathematics program. *Preq:* ED SP 370 or consent of instructor.

**ED SP 823 Teaching Individuals with Disabilities in Integrated Settings 3(3,1)** Strategies for teaching individuals with disabilities in integrated settings; appropriate instruction, accommodations, natural supports, collaboration, and consultation. *Preq:* ED SP 370 or consent of instructor.

**ED SP 840 Transition Education and Services for Individuals with Disabilities 3(3,1)** Postsecondary options for individuals with disabilities; educational programs and services which support their transition from school to life. *Preq:* ED SP 370 or consent of instructor.

**ED SP 841 Instructional Strategies for Individuals with Disabilities in Secondary School Settings 3(3,1)** Instructional procedures for teaching individuals with disabilities in middle and high schools. Research-validated practices in learning strategies, content-area instruction, functional skills, and community-based instruction. *Preq:* ED SP 370 or consent of instructor.

**ED SP 853 Legal and Policy Issues in Special Education 3(3,1)** The impact of legislation-IDEA, Section 504 and litigation on special education; six major principles of special education law; interpretation of court cases; residential placements; discipline; extended school year services; compensatory education; inclusion; strategies to minimize litigation and trends in special education. *Preq:* ED SP 370 or consent of instructor.

**ED SP 854 Applied Behavior Analysis 3(3,1)** Class members accurately recognize, observe, record, and chart inappropriate behaviors; develop behavioral plans based on functional assessment data; determine behavioral objectives; apply behavior analysis principles; and foster student self-management skills. *Preq:* ED SP 370.

**ED SP (ED, ED F) 894 Directed Research 1-4(1-4,0)** See ED 894.

**ED SP 930 Advanced Studies in Special Education 3(3,1)** Examines historical, psychological, and sociological foundations of special education emphasizing current state and federal legislation. Includes investigation of case law and policy that impact special education. *Preq:* ED L 725, ED SP 853, or consent of instructor.

**ED SP 931 Advanced Research in Learning Disabilities 3(3,1)** Investigates history, theory, research, and practice pertaining to selected issues in methods and curriculum within the field of learning disabilities. Employs research-based interventions in the preparation, selection, and adaptation of instruction for students with learning disabilities. *Preq:* ED F 778 and ED SP 821 or consent of instructor.

**ED SP 932 Advanced Research in Emotional/Behavioral Disorders 3(3,1)** History, theory, research, and practice pertaining to selected issues in the fields of emotional/behavioral disorders. Influence of various theoretical approaches in the field. Research-based interventions and curriculum development. *Preq:* ED SP 821.

**ED SP 933 Advanced Research in Mental Retardation 3(3,0)** History, theory, research, and practice pertaining to selected issues in the field of mental retardation; historical treatment; theoretical approaches; research-based interventions; community-based and lifespan curriculum development for individuals with mental retardation. *Preq:* Graduate standing, ED SP 821.

**ED SP 934 Program Models, Evaluation, and Current Trends in Special Education 3(3,1)** Program models, program evaluation, current trends, and issues in programming that impact the growth of special education. *Preq:* ED SP 930.

**ED SP (ED, ED F) 980 Internship in Curriculum and Instruction 1-6(0,3-18)** See ED 980.

**ED SP (ED, ED F) 991 Doctoral Dissertation Research 1-18** See ED 991.



## TECHNOLOGY AND HUMAN RESOURCE DEVELOPMENT

**THRD 610 Selected Topics 1-3(1-3,0)** Subject areas organized according to program needs. Content is planned cooperatively by the University and the school system or agency requesting the course. May be repeated for a maximum of 18 credits, but only if different topics are covered. *Preq:* Consent of instructor.

**THRD 613 Contemporary Technological Problems 3(3,0)** Provides students with an understanding of the problems and contributions of technology. Examples of these relationships are taken from historical accounts and from analyses of contemporary technological intervention both in industrialized and nonindustrialized countries.

**THRD 615 History and Philosophy of Career and Technology Education 3(3,0)** Study of career and technology education programs with the intent of developing a sound individual philosophy. General topics covered are history, local, state, and federal legislation; types of career and technology programs; professional organizations and career guidance.

**THRD 620 Manufacturing II: Computer-Integrated Manufacturing 3(2,3)** Study of computer-integrated manufacturing and its related concepts, including robotics, computer numeric control, electronic pneumatic and sensor systems, programmable logic controllers, and ancillary devices. *Preq:* THRD 220 or consent of instructor.

**THRD 630 Construction Technology II: Practices and Systems 3(2,3)** Study of industrial practices and systems affecting man, materials, and equipment associated with construction industries. Activities are directed toward developing a working knowledge of construction technology and a framework for incorporating this instruction into programs in the public and private sectors. *Preq:* THRD 230.

**THRD 640 Power Technology II: Transmission and Control Systems 3(2,3)** Continuation of THRD 240. Instruction in transmitting and controlling power for utilization in such areas as manufacturing, communications, construction, and transportation. Introduces concepts of automation and robotics to enable the classroom teachers and industry personnel to gain necessary insights into this important area of technology. *Preq:* THRD 240.

**THRD 660 Developing Training Programs for Industry 3(3,0)** Identification, selection, and organization of subject matter for industrial training programs. Emphasizes analysis techniques, session and demonstration planning, written instructional materials development, trainee evaluation, and planning instructional schedules. *Preq:* Senior standing in Workforce Training Concentration or consent of instructor.

**THRD 665 Conducting and Evaluating Training Programs 3(3,0)** Basic concepts of supervision, administration, and management of training programs. Emphasis is on determining training requirements, planning, directing, and evaluating training programs. *Preq:* THRD 160, 460 or consent of instructor.

**THRD 668 Public Relations 3(3,0)** Emphasizes techniques and methods of effective public and industrial relations which contribute to understanding and cooperation of labor, business, professional, educational, and industrial groups.

**THRD 670 Course Organization and Evaluation 3(3,0)** Problems, techniques, and procedures in the preparation, selection, and organization of subject matter for instructional purposes. Methods, techniques, and preparation of materials used in the evaluation of student achievement in industrial education subjects.

**THRD 671 Teaching Career and Technology Education 3(3,0)** Effective methods for teaching and training in career and technology education. Emphasis is given to class organization, preparation of lesson outlines, and audio-visual aids. *Preq:* ED F 335.

**THRD 673 Assessment in Career and Technology Education 3(3,0)** Study of competency testing in career and technology education which includes educational objectives and measurement; construction and use of oral, objective, short answer, matching, essay, and performance tests; and treatment of test data for grade assignments and statistical analysis.

**THRD (AG ED, ED F) 680 Educational Applications of Microcomputers 3(2,2)** See ED F 680.

**THRD (AG ED, ED F) 682 Advanced Educational Applications of Microcomputers 3(2,2)** See ED F 682.

**THRD 683 Architectural Drafting for Career and Technology Education 3(1,6)** Study of the major aspects of architectural drawing such as plot, floor, and foundation plans; wall sections; and elevations. *Preq:* THRD 180.

**THRD 684 Communications Technology II: Systems 3(2,2)** Continuation of THRD 280. Includes theory and operation of communications systems: telegraph, telephone, radio, television, satellites, sound/video recorders, lasers, and computers. Instruction on strategies for interpreting this area of technology to trainees and students is emphasized. *Preq:* THRD 280.

**THRD 686 Instructional Media Development 3(1,4)** Basic instructional media development techniques. Students develop material using authoring software such as HyperCard, transparencies using Persuasion and/or Powerpoint, and fully storyboarded, scripted, and edited digital as well as analog video.

**THRD 692 Advanced Projects 1-6** Students gain depth in content by completing projects under the supervision of an instructor in career and technology education. Written project approval is required before registering. May be repeated twice for a maximum of six credits. *Preq:* Consent of instructor.

## TEXTILES

**TEXT 616 Nonwoven Structures 3(2,2)** Nonwoven fabric structures, their manufacture, properties, and applications. Methods of nonwoven fabric formation, resultant material characteristics and end-use applications are examined. *Preq:* TEXT 201.

**TEXT 622 Properties of Textile Structures 3(2,2)** Yarn and fabric properties, their scientific significance and analysis. Dimensional, structural, and mechanical interrelationships are established and evaluated.

**TEXT 626 Instrumentation 3(3,0)** Principles of industrial and process instrumentation and control as applied in the textile industry; static and dynamic characteristics of measurement devices; transducer principles and techniques of their application for measurement of physical properties such as pressure, temperature, flow, weight, etc.; principles of process controllers; applications of computers in textile process control.

**TEXT 645 Special Topics in Textile, Fiber, and Polymer Science 1-3(1-3,0)** Special topics in textile, fiber, and polymer sciences. A coenrollment course for similar courses in other departments, such as for those students involved in CAEFF projects and CHE 445. There may be different sections in a term to cover different topics. May be repeated for a maximum of nine credits, but only if different topics are covered. *Preq:* Consent of instructor.

**TEXT 660 Textile Processes 3(3,0)** Survey of machinery and processes of textile manufacturing from fiber formation through fabric finishing. For students with a nontextile background.

**TEXT 672 Textile International Trade 3(3,0)** Analyzes the current structure of the international textile trade including imports, exports, tariffs, and trade requirements. Field experience with local firms is used to enhance students' understanding. *Preq:* Senior standing or consent of instructor.

**TEXT 675 Textile Marketing 3(3,0)** Examination of the activities involved in the distribution of textile products in today's market. Emphasis is placed on the role of consumer research and the analysis of fashion in the design and promotion of textile products.

**TEXT 676 Carpet Manufacturing 3(3,0)** Study of the materials, manufacturing technologies, products, and practices associated with the carpet manufacturing sector of the textile industry. Raw materials, product design, formation and finishing systems, evaluation methods, distribution, and end-use applications. *Preq:* TEXT 201, 202, or consent of instructor.

**TEXT 821 Fiber Physics I 3(3,0)** Fiber physical properties and their relationship to fiber structure; methods of investigating fiber structure and physical properties; theories of viscoelastic behavior and thermal properties; models of fiber structure. Offered fall semester only.

**TEXT 822 Fiber Physics II 3(3,0)** Extension of TEXT 821, providing a more in-depth study of the mathematics of polymer fiber viscoelasticity and the solid state thermodynamics of polymeric systems; properties of copolymers; polymer optical and electrical properties; radiation physics of polymers. Offered spring semester only. *Preq:* MTHSC 208 and TEXT 821 or consent of instructor.

**TEXT 830 Textile Physics 3(3,0)** Physical principles underlying manufacturing environments in which fibers, yarns, and fabrics are produced. Physical and mathematical techniques are developed for the study and analysis of the textile plant environment, controls, and energy requirements. Offered fall semester only.



**TEXT 835 Textile Structures I 3(3,0)** Pioneering works relating fiber properties to yarn properties; yarn geometry, fiber arrangements in twisted yarns, extension and breakage of continuous filament yarns, and deformation of staple fiber yarns.

**TEXT 845 Geotextiles and Geomembranes in Engineering Structures 3(3,0)** Covers theory and practice of application of textile materials used in civil engineering constructions, design methods, and technological advances. Also covers fundamentals of soil mechanics and the manufacture of the textile material. Testing and evaluation of the materials is discussed. *Preq:* Consent of instructor.

**TEXT 846 Textile Structures II 3(3,0)** Recent advances in the theoretical and experimental studies on fabric structures; structural mechanics of woven, knitted, and nonwoven fabrics; relationship between yarn geometry and fabric structure; design of industrial fabrics and laminated structures. Offered spring semester only. *Preq:* Consent of instructor.

**TEXT 866 Fiber Formation 3(3,0)** Formation of fibers by wet, dry, and melt spinning are studied in depth with emphasis on rheology of solutions and melts, fiber structure, stretching and drawing processes, and the interrelationships of polymer properties and processes that determine fiber properties. Offered spring semester only.

**TEXT 880 Selected Topics 3(3,0)** Topics not covered in other textile chemistry or textile science courses.

**TEXT 888 Seminar 1(1,0)** Current topics in textiles, fiber, and polymer science. May be repeated for a maximum of five credits. To be taken Pass/Fail only. *Preq:* Graduate standing or consent of undergraduate advisor.

**TEXT 891 Master's Thesis Research 1-12**

**TEXT 991 Doctoral Dissertation Research 1-12**

## THEATRE

**THEA (ENGL) 630 Dramatic Literature II 3(3,0)** See ENGL 630.

**THEA (ENGL) 647 Playwriting Workshop 3(0,3)** Workshop in the creative writing of plays. May be repeated once. *Preq:* THEA (ENGL) 347 or consent of instructor.

**THEA 672 Improvisation: Interpreting and Developing Texts 3(3,0)** Practical applications using drama as a learning tool to strengthen writing skills, motivate collaboration, and heighten analytical skills. Students use improvisation to analyze texts and to revise original work, consider theory and research of contemporary scholars, and develop approaches to literature and composition based on readings and drama experiences. *Preq:* Senior standing or consent of instructor.

**THEA 687 Stage Lighting 3(2,1)** Theory and practice of stage lighting through an understanding of various lighting instruments, lighting control systems, and execution of lighting designs.

**THEA 697 Scene Painting 3(2,1)** Practical study of basic painting techniques for the theatre including layout, proper use of materials, painting styles, and texturing techniques.

**THEA 699 Independent Studies 1-3(1-3,0)** Tutorial work for students with special interests outside the scope of existing courses. May be repeated for a maximum of six credits. *Preq:* Consent of department chair.

## TRANSITION TO TEACHING

**TTT 700 PD: Psychological Foundations of Adolescent Motivation and Learning 3(3,0)** Psychology of learning and developmental processes during the middle and secondary school years. Reviews teaching strategies, achievement motivation, helping relationships, and the impact of peers, schooling, and parents. Includes an introduction to potential problems in adolescence. Restricted to students admitted to the SC TTT program.

**TTT 705 PD: Technology in the Classroom 3(3,0)** Provides a common experience for all students and the opportunity to develop skills needed to use technology effectively in educational settings; hands-on experience with technology and development of subject area strategies for technology integration. Restricted to students enrolled in the SC TTT program. *Preq or Coreq:* TTT 700.

**TTT 706 PD: Cultural Distinctions and Diversity 3(3,0)** Prepares students to meet the needs of a diverse student body through studies of cultural, economic, political, and social environments influencing student achievement. Restricted to students admitted to the SC TTT program. *Preq or Coreq:* TTT 700.

**TTT 707 PD: Community Resources for Educators 3(3,0)** Study of school reform, education trends and programs, and internal and external support resources. Restricted to students admitted to the SC TTT program. *Preq or Coreq:* TTT 700.

**TTT 710 PD: Application of Research in Teaching 3(3,0)** Application of educational research on teaching and learning; dynamics of relating subject matter to students; facilitating student learning; relationships between assessment, learning, and instructing. Restricted to students admitted to the SC TTT program. *Preq or Coreq:* TTT 700.

**TTT 711 Psychological Foundations of Adolescent Motivation and Learning 3(3,0)** Focuses on the psychology of learning and developmental processes during the secondary school years. Reviews teaching strategies, achievement motivation, helping relationships, and the impact of peers, schooling, and parents. Includes an introduction to potential problems in adolescence. Taught on-line. *Preq:* Admission to SC T3 MAT program.

**TTT 715 PD: Student Assessment and Evaluation 3(3,0)** Development and use of educational assessment tools to diagnose students' weaknesses and strengths, monitor students' progress, and determine instructional effectiveness; construction, use, and interpretation of subjective and standard tests and other measurement applications. Restricted to students admitted to the SC TTT program. *Preq or Coreq:* TTT 700.

**TTT 717 Teaching Children with Individual Differences and Exceptionalities 3(3,0)** Basic concepts and issues to prepare students to use effective strategies for teaching learners with exceptionalities and to meet the needs of a diverse student body through studies of learning behavior, and intellectual and cultural factors influencing student achievement. Taught on-line. *Preq:* Admission to SC T3 MAT program.

**TTT 721 Content Area Reading 3(3,0)** Prepares secondary pre-service content area teachers to develop effective reading behaviors, literacy skills, and study strategies in students to enable them to learn increasingly complex content area material. Taught on-line. *Preq:* TTT 717. *Coreq:* TTT 726 and 761, 762, or 763.

**TTT 726 Classroom Assessment Methods 3(3,0)** Development and use of educational assessment tools to diagnose students' weaknesses and strengths, monitor students' progress, and determine instructional effectiveness. Includes construction and evaluation of teacher-made assessments, interpretation of standardized test results, and assignment of grades. Taught on-line. *Preq:* TTT 717. *Coreq:* TTT 721 and 761, 762, or 763.

**TTT 750 PD: Teaching Methods and Strategies for Secondary Science 3(2,2)** Development of instructional practices and materials appropriate for secondary science; familiarization with curriculum standards and materials; includes field experiences in local schools. Emphasis is on inquiry and other student-centered teaching strategies; laboratory management, techniques in science curriculum development and science teaching leadership skills. Restricted to students admitted to the SC TTT program. *Preq:* TTT 700, 705, 706.

**TTT 751 PD: Teaching Methods and Strategies for Secondary Mathematics 3(2,2)** Development of instructional practices and materials appropriate for secondary mathematics; familiarization with curriculum standards and materials; includes field experiences in local schools. Restricted to students admitted to the SC TTT program. *Preq:* TTT 700, 705, 706.

**TTT 752 PD: Teaching Methods and Strategies for Secondary English 3(2,2)** Development of instructional practices and materials appropriate for secondary language arts; familiarization with curriculum standards and materials; includes field experiences in local schools. Restricted to students admitted to the SC TTT program. *Preq:* TTT 700, 705, 706.

**TTT 761 Teaching Methods and Strategies for Secondary Science 3(3,1)** Development of instructional practices and materials appropriate for secondary science; familiarization with curriculum standards and materials; includes field experiences in local schools. Emphasis is on inquiry and other student-centered teaching strategies, laboratory management, techniques in science curriculum development, and science teaching leadership skills. Taught on-line. *Preq:* TTT 717. *Coreq:* TTT 721, 726.



**TTT 762 Teaching Methods and Strategies for Secondary Mathematics 3(3,1)** Development of instructional practices and materials appropriate for secondary mathematics; familiarization with curriculum standards and materials; includes field experiences in local schools. Taught on-line. *Preq:* TTT 717. *Coreq:* TTT 721, 726.

**TTT 763 Teaching Methods and Strategies for Secondary English 3(3,1)** Development of instructional practices and materials appropriate for language arts; familiarization with curriculum standards and materials; includes field experiences in local schools. Taught on-line. *Preq:* TTT 717. *Coreq:* TTT 721, 726.

**TTT 777 Teaching Practicum in a Secondary School 2(0,4)** Application of effective teaching techniques and organization of instructional settings for high school students. Provides an opportunity for secondary pre-service professional educators to examine in-depth the role and responsibilities of the teacher in an educational setting. *Preq:* TTT 721; 726; and 761, 762, or 763.

**TTT 780 PD: Classroom Organization and Management 3(3,0)** Examination of dynamics of discipline and the latest research guiding classroom management principles; numerous discipline models, techniques, methods, and constructs to permit the professional educator to move beyond a singular approach in handling classroom behavior are presented. Restricted to students admitted to the SC TTT program. *Preq:* TTT 700, 705, 706.

**TTT 781 PD: School Culture 3(3,0)** Development of contemporary educational theory and its impact on current schooling practices and educational policy development; analyses of school culture, current trends and best teaching practices. Restricted to students admitted to the SC TTT program. *Preq:* TTT 700, 705, 706.

**TTT 790 PD: Internship Seminar 3(3,0)** Seminar course designed to synthesize skills and instructional techniques developed during course work and classroom experiences. Analyses of classroom instruction and assessment are facilitated through reflective teaching practices. Class discussions, small group activities, and on-line discussion forums are used to explore topics relevant to internship experiences. Enrollment limited to students admitted to the SC TTT program. *Preq:* TTT 707, 715; and 750, 751, or 752.

**TTT 791 Directed Internship 9(0,27)** Application of effective teaching techniques and organization of instructional settings for high school students. *Preq:* TTT 777.

**TTT 792 Capstone Seminar 3(3,0)** Seminar designed to synthesize skills and instructional techniques developed during coursework and classroom experiences. Analyses of classroom instruction and assessment are facilitated through reflective teaching practices. Class discussions, small group activities, and action research are used to explore topics relevant to internship experiences. *Coreq:* TTT 791.

## VOCATIONAL/TECHNICAL EDUCATION

**VT ED 810 Foundations of Vocational and Technical Education 3(3,0)** Evolution of vocational and technical education during the 20<sup>th</sup> century and current trends; sociological, psychological, and philosophical theories underlying current objectives; definition of broad parameters of the field.

**VT ED 812 Vocational and Technical Program Finance 3(3,0)** National, state, and local legislation governing financial support of vocational/technical programs; development of budget, audit, and financial administrative plans and systems. *Preq:* VT ED 810 and ED L 745 or equivalent.

**VT ED 833 Curriculum Construction in Vocational and Technical Education 3(3,0)** Students develop a specific course in a selected vocational and technical education area by specifying performance goals and building around these objectives. *Preq:* AG ED 640 or THRD 670 or equivalent.

**VT ED 850 Programs, Concepts, and Issues in Vocational and Technical Education 3(3,0)** Current activities and debates in vocational and technical education; traditional and innovative programs, career education, school finance, disadvantaged students, handicapped youth, sex equality, and other specialized programs.

**VT ED 861 Administration and Supervision in Vocational and Technical Education 3(3,0)** Principles and practices for administering and supervising vocational and technical schools and classes under federal vocational acts, state regulations, and local policies. *Preq:* VT ED 810 or consent of instructor.

**VT ED 876 College Teaching 3(3,0)** Instructional practices; curriculum; techniques of organizing and planning learning experiences; analysis of teaching strategies and systems.

**VT ED 882 Seminar 1(1,0)** Current issues and problems and proposed research projects.

**VT ED 893 Advanced Research Design and Analysis 3(3,0)** Emphasis on the dissertation from the proposal to the fully developed outline of all chapters. Required of all doctoral candidates in the vocational/technical education program. *Preq:* AG ED (CTE, ED) 889 or equivalent.

**VT ED (ED L) 955 The Two-Year College 3(3,0)** See ED L 955.

**VT ED 980 Internship in Vocational/Technical Education 1-6 (0,3-18)** Internship in which students gain experience working in a chosen area of specialization in vocational/technical education; field experience activities must be planned to build competence in the student's field of specialization. To be taken Pass/Fail only. *Preq:* Consent of the major advisor.

**VT ED 991 Doctoral Dissertation Research 1-12**

## WILDLIFE AND FISHERIES BIOLOGY

**W F B 610 Wildlife Management Techniques 3(1,6)** Covers field and laboratory methods commonly used in wildlife management and research. Students interact with wildlife professionals. Topics include research methodology, estimating wildlife population characteristics, condition measures, and food habits; species determinations, sex and age, capture; population monitoring methods, GIS and mapping techniques, habitat evaluation and improvement. *Preq:* Junior standing; one year of general biology.

**W F B 612 Wildlife Management 3(2,3)** Basic principles and general practices of wildlife management and conservation are covered. Major problems concerning the management of wildlife resources, with emphasis on upland game species. Laboratory work includes practical work on the Clemson University woodlands and field trips to areas where wildlife management is being practiced.

**W F B 614 Wildlife Nutritional Ecology 3(3,0)** Concepts of how terrestrial wildlife obtains and utilizes energy and nutrients in wild ecosystems are taught. Energy and nutrient availability are discussed in the ecological context of distribution, flow, and cycling in natural and modified foraging areas. Physiology of digestion for major homeotherms. Offered spring semester only. *Preq:* FOR 415 or W F B 412.

**W F B 616 Fishery Biology 3(2,3)** Principles underlying freshwater fish production, major groups of freshwater fishes and their habitats. Topics include identification, age and growth, fecundity, food habits, populations estimation, environmental evaluation, management practices, and fish culture. *Preq:* One year of introductory biology, Junior standing.

**W F B 630 Wildlife Conservation Policy 3(3,0)** Deals with the ecological rationale and management implications of public policy designed for the conservation of American wildlife resources. Emphasis is on managed-land issues. *Preq:* W F B 350 or consent of the instructor.

**W F B 644 Wildlife Damage Management 3(2,3)** Covers the philosophical, sociological, ecological, and economic basis for controlling damage caused by animals problem wildlife populations. Emphasis is on fundamentals of prevention and control of damage caused by vertebrate species, especially mammals and birds. Includes interaction with federal and state agencies and private consultants. *Preq:* One year of introductory biology.

**W F B 650 Aquaculture 3(3,0)** Basic aquacultural techniques applied to freshwater and marine organisms; past and present culture of finfishes and shellfishes around the world; principles underlying fish production; water quality, feeding and nutrition as they influence production of cultured aquatic organisms. *Preq:* One year of general biology, Junior standing.

**W F B 660 Warmwater Fish Diseases 2(2,0)** Study of diseases in warmwater fish including infectious and noninfectious processes. *Preq:* One year of general biology, Junior standing, consent of instructor.



**W F B 662 Wetland Wildlife Biology 3(3,0)** Study of wetland wildlife habitats, emphasizing classification by physical, chemical, and biological characteristics; importance of wetland habitat for management and production of wetland wildlife species. Offered fall semester only. *Preq:* BIOL 103/104 or 110/111.

**W F B (BIOSC, ENT) 669 Aquatic Insects 3(1,6)** See ENT 669.

**W F B 712 Wildlife Conservation for Teachers 2-3(2-3,0)** Principles and practices of wildlife conservation providing an overview of wildlife diversity, ecology, and management in the state; population census, wildlife identification, capture and habitat management of game and nongame species. For in-service teachers only. *Preq:* Consent of instructor.

**W F B 809 Seminar in Wildlife and Fisheries Science 1(1,0)** Current literature and research in fisheries and wildlife sciences. At least one presentation is required. May be repeated for a maximum of four credits.

**W F B 810 Publishing in Natural Resource Journals 2(2,0)** Principles of preparing research manuscripts for publication in natural resource journals including searching the literature, communicating with editors, responding to reviews, publication ethics, and performing peer reviews. Offered spring semester of odd-numbered years only.

**W F B 815 Principles of Wildlife Biology 3(2,3)** Theories and principles applicable to wildlife biology emphasizing upland game species. Offered fall semester of even-numbered years only.

**W F B 818 Waterfowl Ecology and Management 3(2,3)** Identification, ecology, and management of waterfowl. Laboratory work includes demonstration and application of relevant waterfowl management techniques, current literature topics, and field trips. Offered fall semester of odd-numbered years only. *Preq:* BIOSC 441 or W F B 412 or consent of instructor.

**W F B 840 Fish Management 3(2,3)** Principles and techniques of managing aquatic systems for recreational and/or commercial fishing, emphasizing streams, rivers, estuaries, and impoundments. Laboratory work includes demonstration and application of management techniques and field trips to observe management practices. Offered fall semester of odd-numbered years only. *Preq:* W F B 416 or consent of instructor.

**W F B 860 Diagnostic Procedures of Warmwater Fish Diseases 2(1,2)** Warmwater fish disease diagnostic procedures employing proper protocol to be followed by a fish disease diagnostician. Offered summer session of odd-numbered years only. *Coreq:* W F B 460 or consent of instructor.

**W F B 861 Selected Topics 1-4(0-4,0-12)** Current areas of aquaculture, fisheries, and wildlife management and research. May be repeated for credit. *Preq:* Consent of instructor.

**W F B 863 Special Problems in Wildlife and Fisheries Biology 1-3(0,3-9)** Research not related to a thesis. Credit varies with problems selected. *Preq:* Consent of instructor.

**W F B 891 Master's Thesis Research 1-12**

**W F B 991 Doctoral Dissertaton Research 1-18**

## WOMEN'S STUDIES

**W S 659 Selected Topics in Women's Studies 1-3(1-3,0)** Topics change from semester to semester and are announced prior to registration. May be repeated for a maximum of six credits, but only if different topics are covered.

## ZOOLOGY

**ZOOL 803 Population Dynamics 4(2,6)** Fundamental mechanisms basic to regulation of natural animal populations. Laboratory research project in population dynamics complements theory.

**ZOOL 810 Behavioral Ecology 3(3,0)** Behavior of animals and the ecological context in which various behaviors are shown; empirical and theoretical aspects of behavioral ecology at individual, population, and community levels. *Preq:* BIOSC 441 and 470 or consent of instructor.

**ZOOL 816 Advanced Ecosystem Analysis 4(3,3)** Description and analysis of ecological systems; biogeochemical, physicochemical, and ecological principles emphasizing fundamental unity of ecosystems and their abiotic environment. Laboratory focuses on application of theory to actual field and laboratory research problems. *Preq:* BIOSC 641, MTHSC 210, 605, or consent of instructor.

**ZOOL 825 Comparative and Veterinary Immunology 3(3,0)** Survey of the evolutionary relationships, the physiology, and the cellular/molecular biology of the immune systems of animals; demonstrations that focus on those animals having high economic input, biomedical importance, or a key ecological position; current research with a historical perspective. *Preq:* AVS 825, MICRO 614, or consent of instructor.

**ZOOL (ENTOX) 830 Mechanistic Toxicology 3(3,0)** See ENTOX 830.

**ZOOL (ENTOX) 831 Biomarkers in Toxicology 3(1,6)** See ENTOX 831.

**ZOOL (ENTOX) 854 Aquatic Toxicology 3(3,0)** See ENTOX 854.

**ZOOL 863 Special Problems 1-4** Research not related to thesis. *Preq:* Consent of instructor.

**ZOOL 891 Master's Thesis Research 1-12**

**ZOOL 991 Doctoral Dissertation Research 1-12**



# FACULTY

- Abbott, Albert G.**, Professor, Genetics, Biochemistry, and Life Science Studies. BS, University of Connecticut, 1976; PhD, Brown University, 1980
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- Abernathy, Larry W.**, Visiting Assistant Professor, Leadership, Technology, and Counselor Education. BA, 1969, MA, 1973, Clemson University
- Abramovitch, Rudolph A.**, Professor, Chemistry. BS, Alexandria University (Egypt), 1950; PhD, 1953, DSc, 1964, University of London (England)
- Acock, Basil**, Adjunct Professor, Horticulture. BSc, Reading University (England), 1962; MS, Clemson University, 1963; PhD, Nottingham Trent University (England), 1967
- Adams, Clementina R.**, Professor, Languages. BA, Atlantico University (Colombia), 1969; MS, 1974, PhD, 1984, Florida State University
- Adams, Tim O.**, Adjunct Assistant Professor, Forestry and Natural Resources. BS, 1977, MS, 1979, North Carolina State University; PhD, Clemson University, 1992
- Adams, Warren P.**, Professor, Mathematical Sciences. BS, Lewis University, 1979; MS, 1981, PhD, 1984, Virginia Polytechnic Institute and State University
- Adelberg, Jeffrey W.**, Research Assistant Professor, Horticulture. BS, 1982, MS, 1987, Rutgers University; PhD, Clemson University, 1993
- Adler, Peter H.**, Professor, Entomology, Soils, and Plant Sciences. BS, Washington and Lee University, 1976; MS, 1979, PhD, 1983, Pennsylvania State University
- Alexander, John C., Jr.**, Breazeale Professor, Financial Planning. BBA, 1984, MBA, 1985, Stetson University; PhD, Florida State University, 1991
- Alexy, Karen J.**, Research Assistant Professor, Forestry and Natural Resources. BS, 1996, MS, 1999, University of Georgia; PhD, Clemson University, 2004
- Allen, Benjamin L., Jr.**, Adjunct Professor, Bioengineering; Chief of Staff, Greenville Unit, Greenville Hospital System. BS, Wofford College, 1960; MD, Duke University, 1964
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- An, Yuehuei**, Adjunct Associate Professor, Bioengineering. MD, Harbin Medical University (China), 1983; MM, Beijing Medical University (China), 1986
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- Anderson, David P.**, Adjunct Professor, Chemical Engineering. BA, Clemson University, 1973; MS, 1977, PhD, 1981, University of Massachusetts
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- Andrew, John R., Jr.**, Assistant Professor, History. BA, University of North Carolina, 1987; MA, Clemson University, 1993; PhD, University of Georgia, 1997
- Andrus, Ronald D.**, Assistant Professor, Civil Engineering. BS, 1983, MS, 1986, Brigham Young University; PhD, University of Texas, 1994
- Angstadt, David C.**, Assistant Professor, Mechanical Engineering. BS, 1987, MS, 2001, PhD, 2004, Lehigh University
- Ankumah, Ramble O.**, Adjunct Associate Professor, Entomology, Soils, and Plant Sciences. BS, University of Cape Coast (Ghana), 1979; MS, McGill University (Canada), 1984; PhD, Ohio State University, 1988
- Appling, Jeffrey R.**, Associate Professor, Chemistry. BS, 1980, PhD, 1985, Georgia Institute of Technology
- Arbena, Joseph L.**, Professor, History. AB, George Washington University, 1961; PhD, University of Virginia, 1970
- Arya, Dev Priya**, Associate Professor, Chemistry. BS, University of Delhi (India), 1996; PhD, Northeastern University, 1996
- Ashton, Susanna M.**, Associate Professor, English. BA, Vassar College, 1989; MA, 1993, PhD, 1998, University of Iowa
- Askew, Curtis L.**, Research Assistant Professor, Family and Neighborhood Life. MA, Northwestern University, 1996
- Askew, George R.**, Director, Belle W. Baruch Forest Science Institute; Professor, Forest Resources. BS, 1976, MS, 1978, PhD, 1981, Clemson University
- Aspland, J. Richard**, Professor, Materials Science and Engineering. BS, 1958, MS, 1960, University of Leeds (England); PhD, Manchester University (England), 1964
- Atkinson, George, Jr.**, Visiting Associate Professor, Parks, Recreation, and Tourism Management; Counselor, Counseling Center. BA, Rhodes College, 1982; MS, 1984, PhD, 1988, University of Memphis
- Austin, Eric M.**, Assistant Professor, Mechanical Engineering. BS, 1980, MS, 1982, University of Illinois-Urbana-Champaign; PhD, Virginia Polytechnic Institute and State University, 1998
- Aziz, Nadim M.**, Department Chair and Professor, Civil Engineering. BSCE, 1978, MS, 1980, PhD, 1984, University of Mississippi
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- Bailey, Kevin M.**, Adjunct Associate Professor, Chemical Engineering. BS, University of Connecticut, 1978; MS, 1983, PhD, 1987, Rutgers University-Piscataway
- Bainbridge, Robert W.**, Director, South Carolina Design Arts Partnership; Lecturer, Planning and Landscape Architecture. BArch, University of California-Berkeley, 1970; MArch, Rice University, 1978
- Baird, William V.**, Professor, Horticulture. BS, Oregon State University, 1976; MA, Miami University, 1979; PhD, University of Virginia, 1983
- Balakrishnan, Nagraj**, Professor, Management. BE, University of Madras (India), 1981; MS, University of Kentucky, 1983; PhD, Purdue University, 1987
- Balch, Clarence A.**, Lecturer, General Engineering. BS, California State Polytechnic University-Pomona, 1959
- Ballard, Robert E.**, Professor, Biological Sciences. BS, 1966, MA, 1968, Miami University; PhD, University of Iowa, 1975
- Ballato, John M.**, Associate Professor, Materials Science and Engineering. BS, 1993, MS, 1995, PhD, 1997, Rutgers University
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- Barczewski, Stephanie L.**, Associate Professor, History. BA, Columbia University, 1990; PhD, Yale University, 1996
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- Barfield, Rayford E., Jr.**, Professor, English. AB, La Grange College, 1961; MA, University of Georgia, 1963; PhD, University of Tennessee, 1969
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- Bellinger, Robert G.**, Extension Associate/Associate Professor, Entomology, Soils, and Plant Sciences. BS, 1974, MS, 1979, University of Maryland; PhD, Virginia Polytechnic Institute and State University, 1985
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- Benson, Eric P.**, Professor, Entomology, Soils, and Plant Sciences. BS, University of Vermont, 1979; MS, Fairleigh Dickinson University, 1984; PhD, Clemson University, 1988
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